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A. C. ARMSTRONG, WESLEYAN UNIVERSITY; ALFRED BINET, ÉCOLE DES HAUTES-ÉTUDES, PARIS; W. L. BRYAN, INDIANA UNIVERSITY; MARY W. CALKINS, WELLESLEY COLLEGE; JOHN DEWEY, J. R. ANGELL, UNIVERSITY OF CHICAGO; C. LADD FRANKLIN, BALTIMORE; G. S. FULLERTON, UNIVERSITY OF PENNSYLVANIA; H. N. GARDINER, SMITH COLLEGE; G. H. HOWISON, UNIVERSITY OF CALIFORNIA; P. JANET, COLLÈGE DE FRANCE; JOSEPH J. JASTROW, UNIVERSITY OF WISCONSIN; ADOLPH MEYER, N. Y. PATHOL. INSTITUTE; C. LLOYD MORGAN, UNIVERSITY COLLEGE, BRISTOL; HUGO MÜNSTERBERG, HARVARD UNIVERSITY; E. A. PACE, CATHOLIC UNIVERSITY, WASHINGTON, D. C.; G. T. W. PATRICK, UNIVERSITY OF IOWA; CARL STUMP, UNIVERSITY, BERLIN; R. M. WENLEY, UNIVERSITY OF MICHIGAN.

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WITH THE CO-OPERATION OF

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The Psychological Review.

THEORY AND PRACTICE.[1]

BY PRESIDENT WILLIAM LOWE BRYAN,
Indiana University.

I.

Two of my predecessors have discussed from this chair the application of psychological theory to practice. Upon the principal question considered by them, as you know, they did not agree. However, difference of opinion upon this point is less surprising than unanimity would be. For time out of mind there have been not simply many divergent opinions as to the relations of theory and practice, but several types of such opinions persisting side by side century after century in collision. In one case it is believed that there is a philosophy, which gives a finally valid account of all reality and which lays down the law for action in every field. In another case, it is not philosophy, but empirical science which, as it develops, is to free us from all the rules of thumb by which our ancestors groped and fumbled their way, and which is to show us with certainty and on rational grounds exactly what to do in every field. In a third case it is not philosophy and not science, not systematic learning of any sort, but intuition, tact, common sense, which alone enable us to achieve success in any field.

The mention of these typical opinions brings to mind at once many great names which could be cited for and against each of them. I have sometimes tried to make the historic conflict of

[1] President's address, American Psychological Association, St. Louis Meeting, December, 1903.

opinion upon this subject concrete for myself by imagining a committee selected from the great philosophers, scientists, poets, and men of affairs of history, the committee being directed, let us say, to act together as trustees of a village school. Plato, Cervantes, Comte, Prince Bismarck, Thomas Carlyle — whom you please, — it would be easy to make up an interesting committee. The debates of that committee, the hopeless reciprocal misunderstandings, the scorn or compassion of each man for all the others, it would take Shakespeare to imagine. And the scene would be worthy of Shakespeare for in a way, the most fundamental conflicts of the history of culture with all their humor and with all their gravity would be there. But even Shakespeare, I fear, could not imagine what the committee would decide to do. And yet decision as to what to do is the unavoidable task of most of us who profess psychology or indeed any science. For we are obliged to propose courses of study and to advise students who have in view one or another profession what courses they shall take. But what courses we propose and what advice we give depend over and over upon what we believe as to the practical usableness of our science. We are therefore each of us bound in conscience to face the question as well as we can, not as one of those questions which may wait upon the leisure of science, but as an always immediate question to which we can scarcely help giving daily some sort of answer to those who look to us for guidance. We are in the position of the conscientious physician who would like to wait for the instruction of another hundred years of experimental medicine but who must do as well as he can with the patient before him. For better or for worse, therefore, I shall give the conclusions which with time have come to me.

II.

The Failure of Theory.

When a theory will not work, as so often the most promising theory will not, I believe the difficulty lies simply in the fact that the theory is not true — not true, that is, with a sufficient degree of approximation. An action is always necessarily

concrete, subject not only to certain known general laws and to certain known definite conditions, but subject to the whole of reality then and there effectively present. No theory completely embraces all the conditions determining any action. Some conditions are omitted unintentionally because of ignorance. Some conditions are excluded intentionally, on the one hand as disturbances which interfere with the accuracy of experimental results, on the other hand as complications which interfere with the possibility of mathematical or logical treatment. The intentional exclusion of disturbing or complicating conditions is not a procedure which requires defense. Its defense is found in the whole history of learning, and after that in the history of the practical applications of learning. To make any progress, we must focus for certain things and be temporarily blind to environing things.

It may be, however, that in arriving at a theoretical result, either because of my ignorance, or because of the very efforts to be exact or to be logical, I shall leave out of account conditions which are not in fact insignificant, which will not be absent when my bit of theory is tried, which will be there to upset all my previsions and to bring me to confusion. My air ship will not fly. In such a case, the best fortune is immediate and decisive practical trial. Decisive failure destroys our illusions, if we have them, and sets us looking for conditions which have been overlooked. Unhappily, however, decisive trial of theoretical results is often indefinitely postponed. In this case, the scholar must be of extraordinary constitution if he escape the historic disease of his kind, namely, blindness to realities which his method has not embraced.

I wish to consider two types of this illusion of the scholar. One of them, which may be called *the illusion of consistency*, is generally recognized. The other, not so generally recognized, I shall call *the illusion of precision*. I wish to show how in both cases these illusions spring directly out of the painstaking employment of methods which must be employed to discover the truth, and how, when they have risen, they render the scholar blind to certain aspects of truth which are not insignificant either in theory or in practice.

The Illusion of Consistency.

I am, let us suppose, a scholar who is impressed above all things with the necessary self-consistency of the truth. Accordingly, I have spent years in developing a system of greater or less extent, which, to my mind, has the quality of complete self-consistency. I have made its consistency explicit, by stating everything in exact logical or perhaps mathematical form. Every term, every proposition or equation, every syllogism or problem is perfectly defined and the whole stands, to my mind, flawless and self-evidential. Everything in it hangs together. Everything in it can be shown to be as certain as the most certain thing in it and that thing no sane man can doubt. Here is the truth, final and clear, and here, within the field concerned, is the law for action.

Whether such a system be finally credited with great value or with small, it is sure to have certain characteristics which limit its value. Its salient merit of exact logical or mathematical consistency was bought at a price. That price was the exclusion of conditions too complicated to be dealt with by the logical or mathematical methods employed. This price was paid by Spinoza in one field and by Newton in another. The procedure requires no defense. It is necessary. There is no definition without negation.

However, a life time spent in developing and contemplating such a system makes it easy to forget and ignore altogether what the method has excluded. Every clear idea, as we know experimentally, makes it harder to do justice to impressions just unlike those which belong with that idea. A system of such ideas is self-protecting somewhat after the analogy of a living organism. Every item in the system is felt to be proof of and proved by all the others. Everything in the system comes to the point of attack, makes me abnormally sensitive for faint experiences of the right sort and abnormally oblivious to salient facts of the wrong sort. In a word, there is perhaps no hypnotic agent more powerful to sharpen the sight or to dull it than a system of ideas which one has made for himself, and whose truth seems guaranteed at every turn by complete internal consistency.

Very likely this hypnotic illusion of consistency is strongest when the system concerned is believed to be all-embracing — a philosophy of God, the world, man, what not; and the illusion is the less likely to be broken because decisive trial is so difficult if not quite impossible. However, it is not simply the philosophers who along with their systems of beliefs, develop the illusion of consistency. No doubt every man does so in a degree and men of science along with the rest. The history of science is full of examples. It is seldom that a scientist is able to do justice to facts which controvert his most important theories. For this reason there is sober truth in the cynical remark that the progress of science requires the death of scientists.

The illusion of consistency as I have said, is very well known, for it springs out of conditions which have been legitimately and conspicuously present throughout the history of learning. And so for centuries this illusion has been notorious as a limitation of the scholar's knowledge and practical judgment.

I turn to an analogous illusion which is less generally recognized.

The Illusion of Precision.

To take a typical case, let us suppose that I am not a logician but an experimental scientist. I cultivate a distrust for philosophy. I am wary of all elaborate argumentation. Logic is a trap. I have studied facts pure and simple. I have lived in the laboratory. I do nothing except with instruments of precision. I have learned how to shut out disturbing conditions with the last degree of refinement. My results are strictly quantitative. Everything has been verified over and over and is verifiable by whom you please *ad libitum*. The outcome is not poetry, not a guess, not a speculation. It is science and within its field, it is the law for action.

It would be idle in this presence to insist upon the value of such procedures and such outcomes. The chief merit of our time lies doubtless in the fact that we have succeeded better along these lines than men ever did before. And yet directly out of the methods which science must employ, there rises over and over again an illusion which stands between the scholar and the truth and which may make him a failure in practice.

Those disturbing conditions which were with infinite pains shut out may be practically insignificant. Or the scientist may take adequate account of them in a separate study. But sometimes they are not insignificant and sometimes after having carefully shut them out of his laboratory the scientist forgets them altogether and does not dream that they are waiting outside his laboratory door ready to take revenge when his formulæ come to trial. Unhappily the necessary practical tests are often long delayed or indecisive. This is true in every field of science and there is no field of science where such delay does not permit the illusion of precision to survive.

But when the phenomena concerned are very complicated, when for example, we confront the complexities of human nature in the individual and in society, when we attack by exact scientific method the problems of psychology, ethics, political economy, or any science dealing with human life and thereupon undertake to tell men what to do, we have then the best possible conditions for the development of the illusion of precision.

For on the one hand it is possible in all these fields to be as precise as one will. There are methods from the older sciences to serve as analogical models. There are, if you like, instruments of the highest precision. One has only to be scrupulous, persistent, intolerant of errors. One will end by securing results, which whatever else may be true of them, are at any rate exact. All this tends to establish in the man who does it a faith which cannot be shaken. There is my machine. There is my mathematical method. There are my statistics. There is my sure concrete fact which no one can deny, which all the world may verify. There is a bit of *science* which will stand till the judgment day and take its place along with all the rest. How can there be any illusion in this? Is not this precisely the death of illusions? Is not this incoming of exact science the beginning of the end of every erroneous conception of human life?

So be it. There rises here nevertheless an illusion from which few of us altogether escape. If I would remember just what my scientific work has actually made known to me,

namely, a fragment, which exists never in isolation but always in flux with innumerable other things which have not been scientifically determined, that would guard me against serious illusion — that would keep me, as a scientist, from believing or from advising or from prophesying except within the safe and narrow limits of my scientific knowledge.

But in fact it is fatally easy to forget how little I know, to forget the whole tangle of things which I have left out through ignorance or shut out in the interest of accuracy, to believe in a word that the whole complex affair from which I have painfully abstracted and defined a fragment goes on by the rules laid down in my monograph.

If one wishes to see the illusion of precision in an extreme and typically clear case he can find it sometimes in a young man just become a doctor. The young man has to his credit one dissertation upon some item of human experience. That has made him an initiate. He has passed from the outside world and is one of those who may speak to the outside world with the authority of science. His work touches great affairs in education, politics, ethics or religion. Time out of mind men have dealt with these affairs by rule of thumb, by their five wits, by what you please. The time for all that is past. This is the age of science. Let all concerned read this dissertation and govern themselves accordingly.

I wish I could say that this illusion were confined to a few unripe doctors of philosophy. In truth, the literature of the sciences dealing with human life overflows with examples, wherein men demand and expect a new education, a new politics, a new ethics, the revolution of institutions, each man assuming to speak with the authority of science, while yet no six of them could agree upon the programme which science requires.

In brief taking for granted that every sort of phenomena admits of and requires exact scientific investigation, I am of those who believe that every bit of knowledge, so far as it is true, is actually or potentially practical. I see no reason why any pulse of consciousness which reflects any aspect of reality may not really and usefully affect action.

It is an obvious fact, indeed, that in some cases the state of our knowledge permits us to formulate rules of procedure such that the results may be foreseen in highly accurate detail, while in other cases such precise prevision and prescription are quite impossible. Naturally the cases where this is possible lie in fields where the phenomena involved are simplest, most easily defined, most thoroughly studied and therefore already most completely understood. These conditions are doubtless found best in the phenomena dealt with in the simpler chapters of mechanics, chemistry, etc., and are most conspicuously absent when we confront the subtle complexities of human behavior. We know how to make soap but we do not know what Shakespeare will say next.

Reflection on this obvious contrast has given rise to the doctrine that there is a difference *per se* between nature and mind such that exact theoretical and practical science is possible in the one case but not in the other. In fact, however, the line between the simple well-understood phenomena where we have exact theoretical and practical knowledge on the one hand and the complex, little understood phenomena where we must guess and fumble and grope is not at all identical with the line which divides nature and mind. Our chemistry, mechanics, physics, biology, etc., confront fields within which nearly everything remains to be done and where we can still do nothing but guess and fumble and grope.

On the other hand we are not without a body of definite verified knowledge of human nature which gives us reliable practical guidance. I can think of no reason why this theoretical and practical knowledge of human nature should not continue to grow side by side with physical science both of them becoming with the years more comprehensive, more exact and more useful.

Nevertheless, the life of the scholar tends to unfit him to succeed practically in any field, tends to make his advice inadequate in every field, unless his work as scholar is tested, corrected and brought into due perspective with things outside his specialty by thoroughgoing practical experience. A lifetime spent in developing a system whose criterion of validity is its

internal logical or mathematical consistency, may bring about a signal advance toward a finally valid view of all truth. In like manner a lifetime spent in intelligent scientific research makes its contribution to theoretical and in the long run to practical knowledge. But never, I believe, does either of these procedures or both of them combined determine all the conditions of any action. Always some of these conditions are shut out through ignorance or for the sake of consistency or for the sake of accuracy. From these excluded conditions the eye of the scholar is holden so that he cannot see them. And when from the height of his learning he tells the foolish multitude what to do, it is not simply the multitude which replies that he also is foolish. It is over and over again the greater reality which, speaking through the event, brings him to confusion.

III.

The Success of Theory.

I turn now briefly to the question, how may we mediate between abstract aspects or fragments of truth and the requirements of practice? There are two answers to this question which have weight beyond any individual opinion.

Concrete Science.

The first answer is given in one clear form by the higher schools of technology. The professors in these schools are in the best cases men who after thorough training in one or another fundamental science, devote themselves to the study of concrete problems for which a practical solution is required.

It is not to be overlooked that such studies have value as contributions to scientific theory. The technical sciences are not simply borrowers from the pure sciences. They exploit new aspects of reality. They establish new facts which 'stand in their own right, throw light upon the less and the more complicated aspects of reality and so do their share toward a future correlation of the sciences into science.'[1] What concerns us now, however, is not the contribution of such studies to scientific theory, but the fact that such studies must be made as bridges between abstract science and practice.

[1] Bryan and Harter, Psych. Rev., VI., 346.

If we inquire for analogous studies within the field of psychology, what showing can be made? We have for one thing a literature dealing with artificially isolated aspects of conscious life, such as will, attention, association and the like. We have another literature dealing experimentally with functions and processes which are in themselves concrete but which in the investigations are isolated from the complex stream of life in which alone they normally occur. We have finally pseudo-scientific literatures, phrenology, physiognomy, and the like, which are concrete enough, and which tell all men specifically what to do, but which science has disowned.

When we have told off these departments of our literature, comparatively little remains, and yet something remains. "Within the fields of comparative psychology, psychiatry, criminal and industrial psychology, we have pictures of the typical conduct of animals, children, melancholiacs, paranoiacs, etc., which instruct us better than unscientific popular psychology can, what to expect and what to do in dealing with individuals of these sorts."[1]

What the future will bring forth in the field of concrete psychology, whether in time the studies in this field will approach in importance the studies which now issue from the technical schools, only the future can show. For myself I have grown in the belief that in a great range of current psychological problems it is good strategy for the experimental psychologist to supplement his investigation of isolated activities and functions by the investigation of concrete activities and functions as they appear in everyday life. I believe that in this direction there lie new chapters in the history of psychology.

Before leaving this point I should like to say that a large part of the work of Professor James seems to me concrete and also practical in the sense which I have indicated. Professor James has not sought to develop a rigidly logical system within which everything should interlock with everything else. He thinks apparently that such a system sacrifices truth to logic. On the other hand his book is not a bare list of findings based upon laboratory statistics. No one has seen more clearly than

[1] *Loc. cit.*, 347.

he how the significant truth may evaporate through the finest mesh of statistics, leaving behind it the illusion of precision. Yet, notwithstanding his avoidance of an extremely systematic psychology on the one side and of an extremely experimental statistical psychology on the other side, his work is on all sides recognized as of quite first rate rank in the history of psychology. What he has done again and again is to satisfy men of many sorts, psychologists and laymen, that he has hit off a bit of life as it is. At the best his sentences are like Flaubert's *phrases viables*. A thing is at last once for all said. These happy achievements which are I believe, as practical as they are true, we owe to the fact that this author has the nearly unique advantage of being a scholar who is also an artist.

Experience with Affairs.

A second indispensable form of mediation between theory (whether abstract or concrete) and practice is found only in personal practical experience with affairs. Many scholars of course never enjoy this experience. Some never wish to enjoy it. It is easy as we know for a professor to become in effect a monk, living apart in his university monastery with cool and distant regard for the society from which himself and the university derive — often with childlike ignorance even of those practical affairs which his own specialty most nearly touches. If such a man does his own business well his social isolation is socially justified. He does one thing which he can do best and all men profit by it. The practical results of such work may, in the long run, prove to be incalculably great. Faraday, Kant or Darwin works fifty years upon a problem which seems remote. The busy public will believe anything of him except that he will ever accomplish anything practical. Yet we know very well that the ideas of such a scholar may in another fifty years quite transform both the ideas and the forms of business of the practical public.

It is equally certain, however, that learning does not effect such results except through scholars who are also men of affairs. It is the extraordinary good fortune of society to have had not a few such men. A Kelvin becomes counselor to engineers. A

Lecky or a Virchau serves in Parliament. A Lowell or a White enters the diplomatic service. An Eliot becomes a university president. In such a case the scholar does not confront society with remote academic advice. With all his learning, experience and will he grapples with men and affairs as they are. He is not there to announce principles. He is there to secure results. His principles are to be made flesh and dwell among us. His learning and his ideals throw their light about him as he works, but in the stubborn and tangled realities with which he works there is also light which in a life time may quite illuminate and transfigure his learning and his ideals. In a word the scholar may at a great price become a statesman. When this occurs, whether on a great scale or on a small one, whether at court or in a village school, we have at last a solution of the ancient problem of theory and practice.

ON THE ATTRIBUTES OF THE SENSATIONS.

BY PROFESSOR MAX MEYER,
University of Missouri.

When I was a small boy, I heard someone talk about sensations and their classification. He said that any sensation was a sensation of one of the five senses, and that each sensation had a quality and an intensity. This is the classification developed by the demand of everyday life. What is or should be the attitude of the psychologist to such a classification?

When I was a little older and received some instruction in psychology, I was told that it was not sufficient to distinguish merely quality and intensity of a sensation, but that there were two other *attributes* of a sensation, duration and extent, but that some sensations had no extent; besides I was told that there were probably more than five senses.

In recent years I read some books and magazine articles written by professional psychologists, criticising the theory of *attributes* and *elements* of consciousness. The criticism, however, was either purely negative or proceeded in a direction which reminded me too strongly of the psychology of a hundred years ago. It seems to me that the psychologists interested in this matter are not sufficiently aware of the fact that a scientific terminology can never mean anything but what we agree to mean by it; that a scientific term does not lose its usefulness by being used in daily life in a sense disagreeing with its scientific meaning.

Some principles of classification of psychological elements are rejected by some critics because the principle is said to be a physical or physiological or epistemological, not a psychological one. I am unable to appreciate in this connection an argument which is based on the distinction of different special sciences, *i. e.*, on a *terminology*. The terminology distinguishing special sciences is as far from being an *absolute* truth as any

more particular terminology. The only criticism of a classification of elements of consciousness which I am willing to admit, is an inquiry into the *scientific usefulness* of the proposed classification of elements.

It is a very serious mistake, from the scientist's standpoint, first to adopt a certain terminology, and then to collect all those facts which fit into this terminology, but neglect all those facts of the same province of experience which do not fit into the adopted terminological system. And yet I am inclined to say that this mistake is almost without exception made by those who write about psychological terminology.

It cannot be enough emphasized, that the principle according to which we call a certain fact of experience either a single sensation or an attribute of a sensation, must permit a *modification* of our particular terminology whenever the progress of our knowledge of facts demands an adaptation of our terminology to these facts. However, some discussions of the terminological problem of sensations and their attributes give one the impression that the author was searching for such a thing as an absolute truth. The problem, if it is to be a scientific problem, is by no means this: *what are the attributes of sensation*, but this: *what facts of experience should we describe under the present conditions of our knowledge by the help of the term 'sensation' and what facts by the help of the term 'attribute'?* If the progress of our knowledge demands it, the terminology not only may change, but even must change. But, while the principle used for establishing a terminology must permit in the future the adaptation of our thought to those facts which will be discovered in the future, the terminology itself must be the means of describing our knowledge of actual facts of the present, not of merely possible experiences of the scientist of the future. We must not describe the known in terms of the absolutely unknown. Therefore the principle according to which we speak of sensations and their attributes must not make use of any hypothesis. A hypothesis is neither at present a fact of experience nor are we sure that it will ever be one in the future. What science needs, is not a possible terminology of the future, but an actual terminology adapted to the facts which we know

at the present time. For this reason I reject Münsterberg's use of his hypothesis of a relation between a psychological atom and the function of a single nerve cell. This relation is at the present time perfectly hypothetical, indefinite, meaningless, unsupported by any particular physiological knowledge, and for this reason cannot be used as a principle of the *terminology* in the science of the present time.

The principle which I propose in the following agrees to some extent with Münsterberg's views concerning the 'elements and atoms of consciousness.' But only to some extent. I believe that the application of my principle to the facts brings about a terminology, which is more useful than Münsterberg's terminology, because it incites us to look first for the facts and then for the terms in which to describe them, whereas Münsterberg, it seems to me, offers a ready-made system of terms and merely invites us to find the facts which fit these terms.[1]

Among the principles proposed for the classification of elements of consciousness is one which is particularly favored by psychologists, namely the principle of independent variability; *e. g.*, a tone may retain pitch and duration, but vary its intensity. The reason why I am opposed to this seemingly very beautiful principle (of independent variability) is, that it does not possess scientific usefulness. I shall prove this at once by referring to a special case. Stumpf pointed out many years ago, that a single tone has the attribute of quality as well as of pitch. This means of course neither more nor less than that the tonal judgments which remain if the judgments of intensity and duration are neglected, should be divided into two distinct classes. For these two classes we must have names, scientific terms, and the best terms seem to be pitch and quality. This division is made for the single reason of its usefulness for the description of the facts. It is self-evident, that, the more superficial a psychologist's knowledge of the facts of hearing, the less he will see the scientific usefulness of the division of judgments into the two classes mentioned. That so few psychologists have paid any attention to Stumpf's division shows how

[1] I have in mind particularly his 'drei Qualitätenreihen, der Art, der Stärke und der Selbständigkeit.' *Grundzüge der Psych.*, p. 285 ff.

little interest the average psychologist takes in the facts of hearing. I am sure that Stumpf's division is exceedingly useful for a scientific description of the facts.

However, if we accept independent variability as the principle of distinguishing attributes of sensations, then this distinction between pitch and quality of a single tone is impossible since a stimulus of a given vibration frequency, producing a single tone, does not permit to vary the pitch independently of the quality, both being dependent on the vibration frequency. But what should determine our acceptance of a certain terminology, its merely formal beauty, or its scientific usefulness? I confess that I do not hesitate to decide in favor of the latter. Independent variability may be a very beautiful principle of classification, but it has ceased to be useful for the description of the facts. It is scientifically sterile.

I shall use in the following the terms 'single sensation' and 'attribute of a sensation,' and I shall call a single sensation a representative of an 'element' of consciousness, an attribute, an 'atom' of consciousness, selecting the latter two words as proposed by Münsterberg. Now, I cannot in advance say what I am going to mean by these four expressions; that would be unscientific. Their meaning can become clear only by their application to the facts. But I will tell at once some things which I *do not* mean by these expressions.

1. I do not mean, when I call a single sensation an element of consciousness, and an attribute of a sensation an atom of consciousness, that there are no other elements and atoms of consciousness but sensations and their attributes. But, these are the only elements and atoms of consciousness in which I am interested at this time. There is no law prohibiting the application of these terms, elements and atoms of consciousness, to other facts of psychological experience ('affectional' and 'transitional' elements and atoms), provided that this application is scientifically useful.

2. I shall limit the present discussion to *peripherally aroused sensations*. The reason why I do this is that otherwise I fear I could not make the matter perfectly clear in a brief paper. I do not deny that there are also centrally aroused sensations.

I doubt, however, if this fact could have any influence on the proposed terminology.

3. I do not admit at all as an argument for or against a scientific terminology its agreement or disagreement with the terminology of life. I do not believe that because 'the words element and attribute (or aspect) are vague and meaningless' in our daily life, they must for this reason be vague and meaningless to the scientist, the psychological theorist. If the theorist would only make up his mind to mean by these words definite facts and nothing suggested by these words in the affairs of the day, these words as psychological terms would be perfectly clear. I shall not begin, however, with a *definition* of these terms according to the rules of formal logic. I merely wish to say, that I regard an element as simpler *in a certain way* than a complex, and an atom as simpler *in a certain way* than an element. In what way simpler? This question cannot be answered in advance. We shall find out in what way *as soon as we use the terms for the description of the facts.* If we stated in advance what we mean by 'simpler in a certain way,' we should be compelled to adapt the facts to the terms. But, as scientists, we wish to adapt the terms to the facts and to mean by *these terms*, whenever we use them in this special science, nothing whatever but *these facts.*

I shall now proceed to an *analysis of a peripherally aroused state of consciousness* (affectionally neutral) and state the principles according to which I propose to classify the theoretical constituents of the actual complex state. I shall use the words 'simplification' and 'elimination' without meaning that eliminated constituents are annihilated, but merely that they are practically pushed beyond the threshold of psychological effectiveness. They may be entirely annihilated, but the word elimination shall not imply this. In the same manner I mean by simplification, that practically our given consciousness must be regarded as simpler, as less complex than another given consciousness, what we mean in life by speaking of concentration of attention contrasted with diffusion of attention. I have to state this in order to prevent any reader from applying arguments of formal logic to problems of scientific terminology.

A peripherally aroused complex state of consciousness can be practically simplified:

1. By either simplification of the objective conditions or concentration of attention, with similar results. If there is such a parallelism of effect, we speak *of single sensations, of elements of consciousness*, in accordance with the classes of judgments directly resulting from this simplification.

2. By concentration of attention only (not also by a simplification of the objective conditions). In this case we speak *of attributes of a sensation, of atoms of consciousness*, in accordance with the classes of judgments directly resulting from this simplification.

[3. By an alteration (but not simplification) of the objective conditions. This case is insignificant for psychological terminology.]

It is necessary to emphasize three points: (1) I did not speak of a simplification of a complex state of consciousness by a mere *alteration* of the objective conditions, but of simplification by a *simplification* of the objective conditions. I did not speak, however, of '*physical and physiological elements*,' because our views concerning such elements are too variable. No two scientists would probably be found in perfect agreement on this matter. But if of two facts, given in the simplest description possible the one is simpler than the other or not, on this question it is comparatively easy to agree. (2) When I speak of the objective conditions (the stimulus) of a fact of psychological experience, I mean those particular conditions which permit *the simplest and clearest definition of a stimulus producing the effect in question*. (3) When I speak of *objective* conditions, I mean here, temporarily, *physical or exterior chemical conditions*. Of course, physiological conditions of the nervous system (like Münsterberg's 'function of a single nerve-cell') are also in a certain sense objective, but we cannot use them, because we cannot define the known by the unknown, because physiological processes in the brain, to which we are accustomed to refer, are as yet almost unknown, chiefly hypothetical, not admitting any definite answer to the question, whether one of them is *simpler* than another one. However, when phys-

iology shall have enabled us to answer this question, there will be no objection to using also the physiological simplicity for the classification of elements of consciousness.

I now have to apply the above terminological principle to all the sensory facts known (so far as this is possible within a limited number of pages). I have to show what sensations and what attributes we have to distinguish according to the principle. And in cases where I have reason to believe that the reader may hesitate to admit the scientific usefulness of the resulting classification, I have to point out wherein its usefulness consists.

Let us imagine the peripherally aroused state of consciousness of a very young infant, exposed to all the normal stimuli of the average day. There can be no doubt that in some respect this consciousness is much more complex than that of the average adult under similar objective conditions. Of course, the adult's consciousness is complicated by a great number of associated ideas, of memory images, of centrally aroused sensations. But these we leave out of consideration. The complexity of the infant's consciousness which I have in mind is referred to by some psychologists, when they call the functional aspect of the infant's consciousness by the name of 'fusion,' that of the adult's consciousness by the name of 'analysis.' We may express this fact also by saying that the infant has not yet learned to concentrate his attention.

Now let us see what judgments may directly result from either simplification of this assumed consciousness of ours by concentration of attention, or similarly from simplification of this consciousness by simplifying the objective conditions. We may imagine that all auditory stimuli are kept from the subject. Also all gustatory and olfactory stimuli. We may imagine the subject as floating in a medium so as to prevent all cutaneous stimulation. And so let us remove all stimuli but those which we call optical. The practical difficulty of such an experiment must not be offered as an objection. There is no doubt that we can *approach toward the limit* (this word is here used as it is used by the mathematicians) where only optical stimuli are active. Every physicist will admit that the description

of this limit is very much simpler than the description of the condition of stimulation from which we started our discussion. And every psychologist will admit that the accompanying consciousness is simpler. But we have to continue our process of simplification. Let us imagine that the optical stimulation was that of a winter landscape, made up of nothing but dark trees, white snow between, and the blue sky above. Or let us imagine that our eye is exposed to nothing but the blue sky and an infinite snow-covered plane; or to the blue sky alone. Is not a complete mathematical description of the stimulus producing the latter experience simpler than the description of the stimulus in the other cases? And is not our consciousness simpler too? Nothing can directly result from it but a judgment concerning this experience of sky-blue. A similar simplification of consciousness can, of course, result from mere concentration of attention. Without simplifying at all the original complex stimulation, the adult mind may pay attention to the color of sky-blue alone and pronounce a judgment thereon.

The problem now before us is this: can this parallelism of the two methods of simplifying our consciousness be traced farther than to this point? Let us agree that the only impression which concerns us be the blue sky of the winter landscape. Can we not pronounce more than one class of judgments concerning this sky-blue? Can we not say that it is large (compared with the white and black remainder below), or that it is bright, or that it is blue? No doubt, we can simplify our consciousness by concentration of attention in such a way that only one of the judgments mentioned directly results. But can we also simplify the objective conditions so that the directly resulting judgment can be one of, say, brightness only? I shall show in detail that such a parallelism no longer exists here.

How can we determine by the simplest physical definition, under a given condition of sensitiveness of the eye, what we mean by blue, or violet, or a neutral gray, or black? In a more primitive stage of physical science the physicists used for this definition the infinite number of homogeneous lights of the common solar spectrum. We can use this primitive physical

definition of a stimulus producing a certain visual experience, if we intentionally or unintentionally overlook its imperfection, for the application of the proposed principle of psychological classification. A difficulty arises in this case for the psychologist only with respect to the colors, which are not in the spectrum, *i. e.*, the purples which are more reddish than the violet of the spectrum. I shall actually show how we can use this definition to this extent. However, those who are familiar with the multitude of facts which we call physiological optics, will urge at once, that the only objective definition of any visual sensation, which is satisfactory to the physicist, is the definition by means of an equation containing as three constants three selected homogeneous lights. I copy a physical definition from Helmholtz's *Handbuch der Physiologischen Optik*, p. 341:

"Wenn wir die Grundfarben und ihre quantitativen Einheiten R, G, V gewählt haben, dann kann der physiologische Eindruck jeder andern Farbe F dadurch vollkommen beschrieben werden, dass wir sagen, sie sehe so aus, wie eine Vereinigung von so und so viel Einheiten R, G, und V. Also, wenn wir mit x, y, z Zahlen bezeichnen,

$$F = xR + yG + zV."$$

I shall now first use the physical definition of a stimulus (producing any visual sensation) by means of the infinite number of homogeneous lights. We have to answer the two questions: (1) Is the sensation produced by homogeneous light of a certain point of the spectrum (say, blue) simpler than the sensation produced by homogeneous light of another point of the spectrum (say, violet)? The answer to this question must be that the sensation blue is simpler in a certain way than the sensation violet. For we can judge violet with respect to its duration, its extent, its brightness, its bluishness, and its reddishness. Each of these judgments implies a simplification of our state of consciousness by concentration of attention. But we can judge the sensation blue only with respect to its duration, its extent, its brightness, and its bluishness. Blue therefore is simpler in this way just mentioned than violet. (2) But can we produce a simplification of our consciousness with a similar result also by simplifying

the objective conditions? The answer to this second question must be negative. The homogeneous light producing the sensation blue is not simpler than the homogeneous light producing the sensation violet. We have to say, therefore, in accordance with our terminological principle, that violet is not a sum of sensations, but a single sensation in the same sense, in which blue is a single sensation. Does not the reader instinctively agree with this result?

We must now answer the same two questions with respect to 'blue' and 'gray': (1) That the sensation blue is in a certain way less simple than the sensation gray, cannot be doubted. For we can produce by concentration of attention each of the judgments concerning blue which we can produce concerning gray, and one in addition, that of bluishness. (2) The physical stimulus, however, which the physicist would use for the definition of blue, is simpler than the stimulus of gray. The stimulus of gray would have to be defined as the stimulus of blue plus a certain additional stimulus, or two additional stimuli, or more than two additional stimuli; *i. e.*, the stimulus of gray is the sum of two, three, or more homogeneous lights. We do not have, therefore, in this case, a physical simplification parallel to the simplification by concentration of attention. Therefore we must say, in accordance with our terminological principle, that the sensation blue is a single sensation in the same sense in which the sensation gray is a single sensation. I should think that the reader will agree with this result.

Let us further answer the same two questions with respect to white and black: There can be no doubt that the objective condition of white is less simple than the objective condition of black, the latter being merely negative. However, black does not permit any simplification by mere concentration of attention, which white would not permit also; black is not simpler than white. There is no parallelism of the two methods of simplifying our consciousness according to our principle.

The result of this application of our terminological principle to the facts which we know at present, is then this: The principle requires us to call any visual sensation which is uniform over a certain area of the field of vision, a single sensation, not

a sum of sensations. We must speak of two or more visual sensations only in case we have two or more different areas within the field of vision.

The next question to answer is now this: Which classes of judgments are to be distinguished as directly resulting from a further simplification of single visual sensations by concentration of attention only? *I. e.*, which are the *attributes* of visual sensation? The classes of judgments which we have to distinguish are so far as my knowledge reaches, the following: duration, extent, brightness, bluishness, yellowishness, greenishness, and reddishness. These are the seven attributes of visual sensation, in accordance with the terminological principle and the present condition of knowledge.

I do not fear that anyone will raise the objection that the element of consciousness which we call visual sensation, cannot have *seven* attributes, since it is an *a priori* truth that any and each sensation has four attributes (with the exception of some which have only three). If a man pretending to be a scientist would argue in that way, I should simply leave him alone. I fear, however, that some psychologist might object to the above result, because *no particular sensation ever possesses all those seven attributes*. Yet this is not a scientific objection.

Does not the chemist call gold a chemical element, although it is sometimes solid, sometimes liquid, but never solid and liquid? Why should any particular experience of an element of consciousness be required to possess all the possible attributes of this element?

And further, this is not a singular fact, peculiar to visual sensation. We shall later see, that in the auditory element of consciousness too we find some particular auditory sensations which do not possess all the attributes of the auditory element.

I believe that it is one of the fundamental tasks of experimental psychology, to determine the laws governing the mutual relation between the attributes of a single sensation as well as the mutual influence of the attributes of several sensations. Some of the most important laws of the attributes of visual sensation are these:

1. The attributes yellowishness and bluishness do not coexist in a single sensation.

2. The attributes reddishness and greenishness do not coexist in a single sensation.

3. The attributes yellowishness, bluishness, greenishness, and reddishness may be absent altogether in a single sensation. The other three attributes are always with a certain vividness present in the conscious experience of a visual sensation.

Facts like these are not objections to the proposed terminology, but simply *the natural laws of the attributes of visual sensation*.

As children in school, we used to wonder why our teacher told us sometimes that a solution of an arithmetical problem was wrong in spite of the fact that the result was right. Now in the above classification of the attributes of visual sensation, I believe that the result is right, *i. e.*, scientifically useful, in spite of the fact that I made *two* mistakes: (1) I started from a physical definition which is too primitive, and (2) I used the trick of omitting from discussion the purples which are reddisher than the violet of the spectrum.[1] I did this because psychologists (and physicists) sometimes use and have to use this primitive physical definition in elementary instruction; when the student hears about this matter for the first time. I shall now apply my terminological principle to the facts while using the more perfect physical definition of Helmholtz, as above stated. We shall see that this results exactly in the above classification of attributes, so that the above classification is indeed the one to be accepted.

The equation $F = xR + yG + zV$ can be *simplified* in no other ways than by rendering either one or simultaneously two or all three of the numbers x, y and z equal to zero. Now, let us apply this fact to some particular experiences, the experiences of R, G, blue, purple, gray and black. R, G, and purple permit each five of the seven classes of judgments (above mentioned as attributes) by means of concentration of attention. *E. g.*, R permits the judgments of duration, extent, brightness,

[1] Someone might point out (justly) that a parallelism of simplification of consciousness does exist in the case of purple and blue ('Urblau'), since the latter can be defined by one homogeneous light, the former not by less than two. When we use the scientifically more perfect physical definition of Helmholtz, no such difficulty of an apparent contradiction arises.

reddishness and yellowishness. Blue permits only four. But the sum on the right side of our equation contains only one member in the case of R or G, at least two members ($F = xR + zV$; but it is improbable that the brightness should happen to be such, that y is equal to zero) in the case of purple, and at least two members (probably again all three) in the case of blue. It is impossible, therefore, to speak in these cases of a parallel simplification of our state of consciousness by either simplification of the objective conditions or concentration of attention.

Further, the experience of gray permits only three judgments resulting directly from a mere concentration of attention; the experience of blue permits four; the experience of V permits five. But the physical definition by Helmholtz's equation is simplest in the case of V; less simple in the case of blue; and least simple in the case of gray. There is no parallelism of the sort we are looking for.

Further, the experience of gray permits by concentration of attention three classes of judgments, concerning duration, extent and brightness. So does the experience of black. That the stimulus in the case of black is defined in the simple way $F = O$, does not establish any parallelism of the sort in question.

We must repeat therefore what we stated above:

Any visual sensation which is uniform over a certain area of the field of vision, must be called a single sensation, not a sum of sensations. The attributes of visual sensation are: duration, extent, brightness, bluishness, yellowishness, greenishness, and reddishness.[1]

Let us now consider a case in which the objective conditions of stimulation have approached the limit at which we need not speak of any but acoustical stimulation. Let us imagine that the stimulus consists of three sine waves of the frequencies 300, 400 and 500. We say that we hear several tones. No one

[1] I have been criticized by Mrs. Ladd-Franklin for saying: Die Heringsche und die Helmholtzsche Theorie ergänzen sich gegenseitig. I did not mean by this that both of them were *psychological theories of color-vision*. This name can be given only to the Hering theory. What I wished to express by the words above quoted is my conviction that we cannot get along in psychology without the Helmholtz theory. And I hope to have made clear now, in what sense this is true.

denies that a stimulus consisting of only one of these sine waves is physically simpler. We hear in this case one tone only. We can produce a similar result, without simplifying the stimulus, by merely concentrating our attention. We concentrate our attention on one of the several tones; and only judgments concerning this one tone result directly. A further simplification of our state of consciousness by simplifying the objective condition is impossible, since one sine wave is as simple as any other. We therefore say, that the tone we hear is a single tone, not a sum of sensations.

But a further simplification of our state of consciousness by concentration of attention only is entirely possible. Four classes of judgments may directly result: judgments concerning duration, intensity, quality,[1] and pitch. These are therefore the four attributes of auditory sensation.

Since the average psychologist takes so little interest in auditory sensation, I shall have to point out in some detail, in what respects it is useful to distinguish judgments of quality and judgments of pitch as two classes. I shall state a number of facts, most of which seem to be quite unrelated facts as long as we fail to make the above distinction but become interesting as particular cases of more general facts as soon as we refer them to the one or the other class of judgments.

There are two reasons why this distinction of the attributes of quality and pitch of auditory sensation is not generally made. One reason is that this distinction does not agree with the old-fashioned, but nevertheless absurd theory, that any sensation has either the four attributes of quality, intensity, extent, and duration, or the three attributes of quality, intensity, and duration. The other reason is that it does not agree with the principle of independent variability, quality as well as pitch being dependent on the vibration frequency; but psychologists should keep in mind that the terminological principle of independent

[1] I use the term 'quality,' because in English this is the term which is daily used by every maker of musical instruments when he is conscious of that sort of judgment. The reason why the psychologists do not like this term, is no other than its not fitting into their artificial systems. However, it is the best term I know. In German we should use Stumpf's term 'Tonfarbe' ('Klangfarbe' for a mixture of qualities).

variability is not a divine revelation. It has no claim for existence beyond its usefulness.

1. We can theoretically understand the difference between a 'pure noise' and a 'tone,' if we regard a tone as an auditory experience under such conditions material for the function of attention, that all four classes of judgments may directly result; a pure noise as an auditory experience made up of brief tone sensations under such conditions for the function of attention, that no judgments concerning pitch can result. *I. e.*, we may judge, that this noise is 'higher' (referring to the mixture of qualities, the mean quality) than another noise; but we cannot say that this noise is in unison with the other noise, or that it is its fifth, or a mistuned fifth. More details about the physical conditions of stimulation producing a pure noise are to be found in my paper 'Zur Theorie der Geräuschempfindungen.'[1]

2. In demonstrating to students very low and very high tones, say below 30 and above 8,000 vibrations, I have found that quite commonly my hearers refuse to call these sensations 'tones.' They incline to call them noises. This is not wonderful to the psychologist who is aware of the fact, that these tones do not possess the attribute of pitch (they cannot be musically employed), while they possess the attributes of intensity, duration and quality. Such a tone may be said to be lower or higher (referring to quality) than another tone, but it cannot be said to be its third or its fourth. The difference between the experience of such a tone and a pure noise consists merely in the fact that theoretically we regard the latter's quality as a mixture of qualities, the former's quality as a single quality.

3. The theoretical distinction between tone and noise is entirely different in kind from the theoretical distinction between, say, blue and yellow. We may compare, in some respects, a tone with a uniformly colored piece of paper, a noise with a painter's palette, or rather with a flickering color-wheel. The only respect I can see, however, in which the distinction of tone and noise can be identified with the distinction of blue and yellow, is its practical significance. To distinguish between tone and noise is *of equal practical importance in life* as to distin-

[1] *Zeitschrift für Psychol. u. Physiol. d. Sinnesorgane*, 31, p. 233.

guish between yellow and blue. But who ever thought of basing the terminology of pure science on such a consideration! Why not say, then, that the distinction between a horse and a steam engine is the same as the distinction between ice and glass? With respect to practical importance it certainly is. But scientifically?

4. The technical problem which the organ builder has to solve is this: He is required to construct single sources of sound which impress us as possessing the same pitch, but different quality. He solves this problem by making use of this *important law* of auditory attributes in a plurality of auditory sensations: We can easily pay attention simultaneously to several pitches so that several judgments directly result, but with great difficulty only to several qualities so that several judgments directly result, unless we pay attention to their corresponding pitches too. And we can easily concentrate our attention on a single pitch, but not on a single quality; if we try to pay attention to the corresponding quality, the resulting judgment of quality is as a rule a judgment determined by all the qualities of the several tone sensations present. This is the law which the organ builder uses in order to obtain the desired effect (but which seems to be unknown to most psychologists, who take only a slight interest in the fundamental laws of hearing). By using the physical fact of partial vibrations of elastic bodies, he combines several tone sensations of which one has a far greater intensity than the others. This intensity attracts our attention to this one sensation more than to the others, and we judge to hear one pitch because our attention is concentrated on one pitch. Our judgment of quality, however, is, we may say, *an auditory illusion*, entirely comparable with a certain class of geometric-optical illusions.[1] It is self-evident that the mellowest quality which an organ builder can give to a single source of sound is the quality of its fundamental tone (without overtones), since an elastic body may produce overtones, but does not produce undertones.

[1] Compare Schumann, *Zeitschrift f. Psychologie u. Physiol. d. S.* v. 24, p. 7, 1900. "Die eigentlich zu vergleichenden räumlichen Grössen bestimmen nicht allein das Urteil, sondern die Ausdehnungen benachbarter Eindrücke wirken mit."

5. Musical effects depend on the hearer's paying attention to the pitches. Our congenital ability in this respect differs individually. There are some individuals, however, who are not normally affected by musical relationships in spite of a maximum practice and effort to pay attention to whatever there may be in their auditive consciousness. We describe their condition by saying that they are 'pitch-deaf' (similarly as we call some individuals 'green-blind'). We are all of us pitch-deaf for the lowest and highest auditory sensations (similarly as we are all of us green-blind on the peripheral parts of our field of vision). For the individuals mentioned auditory sensation possesses only three attributes, duration, intensity and quality. To their class belong probably those rare cases, reported in psychological literature, of individuals who could sing a tune in the key in which they had learned it, but not in another key. They sang by a memory for quality, not by a memory for pitch. Melodic relationships are the relations (on a certain unknown physiological basis) of the pitches of the auditory sensations.

We need not wonder why the attribute of pitch in auditory sensation is sometimes lacking, while the attributes of intensity, duration and quality are always present. We have found analogies in visual sensation.

The terms 'high' and 'low' are ambiguous. When we speak of tones as being high and low, we refer sometimes to pitch, sometimes to quality. This ambiguity is the cause of some disagreements in experimental practice as well as in theoretical discussion.

6. The 'absolute memory for pitch' is actually much less a memory for pitch than a memory for quality. It is a well known fact that quite frequently individuals are able to name the tones of a certain musical instrument (*e. g.*, the piano), but not those of another musical instrument (*e. g.*, the human voice). If we call this memory an absolute memory for quality, as we have a right to do from other reasons too, the fact mentioned does not require any particular explanation at all, since the 'mean quality' of the sum of auditory sensations produced by singing *c* is very different from the mean quality of the sum of auditory sensations produced by striking *c* on the piano. The

pitch, if we pay attention to this attribute, of the strongest sensation in either case is the same, but the name *c* is absolutely associated not with this pitch, but with the quality of the piano *c*.

The physiological processes in our nervous system, which underlie the experiences of pitch and quality, are probably no less different than the physiological processes underlying the experiences of extent and brightness in visual sensation.

7. There has been a discussion in psychological literature (I will mention only the names of Stumpf and Ebbinghaus) whether we have a right to call a tone more *similar* to its Octave than to its Third, after we have agreed to call a tone more similar to another tone by three vibrations higher, less similar to another tone by six vibrations higher. It is here as in so many other cases in science, that a problem is discussed with many arguments in this or that direction, while there is no problem at all. It is clear that there is no scientific problem of this sort left for discussion as soon as we adopt the distinction between the two attributes of pitch and quality. Or should we not have the right to say, that a circle is more similar to an ellipse than to a rectangle, after we have agreed to call a circle of medium gray more similar to one of dark gray than to one of black?

The above facts seem to me to express the most important natural laws governing the attributes of auditory sensation.

Let us now consider a case in which the objective conditions of stimulation have approached the limit at which we need not speak of any but gustatory stimulation. We can physically define any given gustatory experience by saying that it is the same experience which we have when the stimulus is made up of certain quantities of four substances in standard solutions, as shown by the equation

$$G = xAc + yBi + zSa + uSw,$$

e. g., of tartaric acid, quinine, common salt, and sugar. By concentration of attention we can simplify such a state of consciousness so that only the judgment sweet, none of the judgments sour, bitter, or salt, directly results. The same is possible by simplifying the stimulus according to the equation.

Can we further simplify our state of consciousness which we call sweet by concentration of attention? We can; and two classes of judgments may directly result, judgments concerning more or less sweetishness and judgments concerning duration. But is also a parallel simplification possible by simplifying the stimulus according to our equation? This is impossible, for the equation does not become simpler by a variation of u. We must say, therefore, that the state of consciousness produced by a certain solution of sugar is a single sensation, and that its duration and its intensity are its two attributes.

The sensation of sweetness, then, has the attributes of intensity (sweetish, sweet, luscious) and duration, but not of 'quality.' Sweetness is not an attribute of sweetness. Else, we should have to call visuality an attribute of visual sensation, auditiveness an attribute of auditory sensation, acidity an attribute of sourness. We need not say that what distinguishes a certain single tone from the visual sensation of the blue sky, is their different 'quality,' pitch and blueness. For we have just as much right to say, that what distinguishes them, is the tone intensity on the one hand and the brightness on the other hand. This consideration seems to have been the basis of Münsterberg's distinction of 'drei Qualitätenreihen, der Art, der Stärke, und der Selbständigkeit.' These 'Qualitätenreihen' seem to be a very simple expression of the laws of sensation. However, Münsterberg's terminology, as well as the terminology which speaks of the two attributes of quality and intensity of any and each sensation, makes us believe that simplicity of psychological law reigns over a province of facts, where actually there is a great diversity of laws. Simplicity of description is the aim of science. But the pretension of simplicity, where there is no simplicity, by means of adapting the facts to the terms is worse than no science. I do not see the necessity of having a general term ('quality') for sweetness, visuality, auditiveness, etc. Let us simply speak of different departments into which our sensations as such, without respect to their attributes, may be classified. And let us say, that some four of these sense departments, namely sweetness, sourness, bitterness and saltness, are in some respects (with respect to certain reactions of ours) so

closely related, that we may call these four departments by the common name of a sense of taste. If we do this, we do not make the mistake of asserting simplicity where there is none and using complicated description where the facts are simple.

One fact concerning the sensations of sweet, sour, bitter and salt deserves to be mentioned in this connection. Those who speak of 'the quality of taste' and 'the quality of color' and other 'qualities' have to admit the peculiar fact that most of their 'qualities' are of the form of a continuous series, while 'the quality of taste' consists of four discrete points only. Those who are accustomed to mathematical thought must suspect under such circumstances, that the distinction of these 'qualities' of the psychologists is not the result of the consistent application of a definite scientific principle. And indeed it is not. Those 'qualities' are the outcome of practical necessities, not of scientific thought. They are mainly those attributes of the several sensations, which happen to be particularly important in man's struggle for life. Of course, I do not deny that some one attribute of a sensation is practically more important than others. But I do not see why such a fact should be expressed by *the terminology of a pure science*. Unfortunately the number of psychologists is still too great who regard psychology as an art rather than as a science.

I might go on and apply the terminological principle to all the other sense experiences. I merely fear to tire the reader. The following table shows the result of the application of the terminological principle to the facts, so far as the facts are at present generally agreed on by the psychologists. If our knowledge of the facts progresses, the application of the principle to the facts may lead to the addition of elements and atoms or to changes in what I now propose to call in each case a particular sense department. However, a principle which did not permit such modifications of our thought, would not be a scientific principle. By 'element,' of course, I do not mean the special sensation of a special individual at a special time, but an abstraction. Similarly as the 'element gold' of the chemist does not mean the liquid gold in a certain smelting furnace or the gold in a gold bath of a certain photographer, but an abstraction.

TABLE OF THE SENSATIONS.

Sense Departments Distinguishable at Present. (Peripherally Aroused Elements of Consciousness.)	Groups into which some Sense Departments are Collected at Present. (Senses).	Attributes Known at Present. (Possible Atoms of Each of the Peripherally Aroused Elements of Consciousness. Their Number Differs in the Several Elements.)
1. Visual sensation.	Vision.	Duration, extent, brightness, bluishness, yellowishness, reddishness, greenishness.
2. Auditory sensation.	Hearing.	Duration, intensity, quality, pitch.
3. Sweet sensation.	Taste-sense.	Duration, intensity.
4. Sour sensation.		Duration, intensity.
5. Bitter sensation.		Duration, intensity.
6. Salt sensation.		Duration, intensity.
7. Warmth sensation.	Cutaneous sense.	Duration, extent, intensity.
8. Cold sensation.		Duration, extent, intensity.
9. Pressure sensation.		Duration, extent, intensity.
10. Pain sensation.		Duration, extent, intensity.
11. Muscular sensation.	Organic sense.	Duration, intensity.
12. Tendinous sensation.		Duration, intensity.
13. Articular sensation.		Duration, intensity.
14. Sexual sensation.		Duration, intensity.
15. Static sensation.		Duration, intensity.
16. Olfactory sensation *x*.	Sense of smell.	Duration, intensity. Further attributes?
17. Olfactory sensation *y*.		Duration, intensity. Further attributes?
18. Olfactory sensation *z*.		Duration, intensity. Further attributes?
19. Other olfactory sensations?		Duration, intensity. Further attributes?
? Other sense departments?	?	?

Some one may object to speaking of 'visual sensation' as an 'element' of consciousness, because 'blue' is as 'elementary' as 'yellow.' To him I have to say, that a chemist speaks of mercury as an element, although it may be hard or soft or liquid or gaseous. He calls mercury an element nevertheless. Why should the psychologist not call visual sensation an element in spite of the fact that it is sometimes blue and sometimes not blue? The chemist justifies his terminology by pointing out the scientific usefulness of this particular usage of language. And I believe that it is equally justifiable to speak of visual sensation, without reference to any of its particular attributes, as an element of consciousness. That the natural laws of chemical elements and atoms should be identical with the natural laws of the elements and atoms of consciousness, is an arbitrary requirement. For scientific terms need never mean anything beyond what we agree to mean by them.

AN INQUIRY INTO THE NATURE OF HALLUCINATION.

II.

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I.

A peripheral process often of a pathological nature, a state of dissociation and a subexcitement of secondary sensory and ideomotor elements constitute the main conditions of hallucinations. The peripheral pathological process and the state of dissociation are requisite to the formation of the hallucinatory percept, while the content of such percepts are given by the systems of sensory-motor and ideomotor elements. A peripheral process alone even if it be pathological in character does not give rise to hallucinations. Similarly a state of dissociation by itself or a state of subexcitement of secondary and representative elements cannot give rise to hallucinations. It is only when these conditions coöperate, it is only then that hallucinations arise. The state of dissociation and that of subexcitement of 'central' systems may be regarded as the 'central' conditions of hallucinations, while the peripheral process is the factor that supplies to the systems the primary sensory nuclear elements round which the secondary elements crystallize and form a hallucination.

States of dissociation, provided the other conditions are present, are preëminently favorable to the formation of hallucinatory percepts. In sleep, when the mind is immersed in darkness, isolated isles of systems may stand out of this general night of consciousness and give rise to dreams of various degrees of intensity. Dreams are sleep hallucinations, while hallucinations are waking dreams. Both hallucinations and dreams develop under the same conditions of dissociation. The nature of

dreams and hallucinations are essentially the same. An isolated dissociated system of secondary sensory and representative elements predisposed to function become awakened by a special peripheral stimulus or by a summation of series of stimulations and gives rise to hallucinations or dreams according to the general state of consciousness, waking or sleeping. The hallucination of the comparatively waking state stands out alone, it remains more or less isolated and becomes obliterated by the general inrushing flood of peripheral sensations and perceptions of the waking consciousness. The dream is made up of a series of hallucinations going sometimes to form a complicated hallucination expanded into a whole life history. From this standpoint we may say a hallucination is an abbreviated dream, while a dream is an expanded hallucination.

In sleep the primary sensory nucleus of the dream hallucination is supplied by the peripheral processes coming either from external stimuli or from internal stimulations, from changes taking place in the organism. The psychophysiological threshold is raised in sleep, the resistance to the entrance of sense impressions is increased, the rise being proportionate to the depth of the sleep state. The peripheral sensory channels are closed to external stimulations. External stimuli, however, assail the peripheral sense organs from all sides and now and then, whether on account of the intensity of the stimulus or of the summation of a series of stimulations or of the temporary rise of the sleep level and consequent fall of the threshold and decrease of resistance to the influence of external stimuli, sense impressions force an entrance and awaken to activity some slightly slumbering systems thus giving rise to the dream hallucination. Under such conditions the sense impressions have but small chance to awaken its appropriate systems and hence become incorporated into any chance system they happen to awaken thus giving rise to the phantastic combinations characteristic of dream life. The sense impressions form the nucleus around which cluster systems of secondary sensations and representations all tinged with the sensory color derived from the original primary nuclear sense impressions. The systems of secondary sensory and representative elements once awakened

may go on expanding and developing, awakening other groups and systems, assimilating them or being assimilated by them as much as the nature of their content permits and being further reinforced by incoming stimulations. During the whole course of its expansion the aroused groups and systems maintain their sensory or rather their perceptual character. For, if a system is once awakened to activity, the threshold, the resistance to incoming stimulations is lowered and many more sense impressions gain access to the functioning systems and become incorporated and assimilated. This assimilation of chance systems and sense-impressions often give birth to highly elaborated phantastic dreams and visions.

II.

Systems awakened by stimuli must have some relation of familiarity to the nuclear sense impressions. If perception is to take place, there must be some congruence between the sense impressions and the stimulated systems. Only on such conditions can assimilation take place. Similarly the awakened systems in sleep assimilate congruent sense impressions, the latter becoming so transformed as to fit the system and the system is modified by the incoming impressions. This congruence in the dream state is often strained and remote and consequently often of a phantastic and irrelevant character. Thus the taking off a plaster may give rise to a dream of being skinned alive, or of being scalped by an Indian. A change to an easier position and a freer respiration may generate a dream of flying. In one of my experiments of dream hallucination the uncovering of the feet in a cold room gave rise to the dream of walking on the frozen surface of a river and the impeded respiration awakened the feeling of fear of falling into the water.

The internal sensations such as arise from the different functions of the bodily organs are very important factors in the generation of dream hallucinations. Every one knows the fact that indigestion often gives rise to nightmares and unpleasant dreams, but not many realize the fact that cœnæsthetic sensations, sensations that come from our internal organs play a very important rôle in the production of dream hallucinations. The

circulation of the blood, the secretion of the various glands, the peristaltic movement of the small intestines, the action of the stomach, the changes in the muscles, the metabolism going on in the various organs of the body, in the cells of the organism, all these give rise to sensations which, though obscure and confused, go to make up the general sense of organic life activity. The sense of cœnæsthesis may in fact be regarded as the basis of our physical being or of our physical personality. A change of this sense is frequently an important factor in the formation of delusions, when mental life becomes dissociated and disaggregated. Hypoæsthesia or anæsthesia of the leg, for instance, may form the nucleus for the formation of the delusion that the leg is made of glass or of putty or is totally gone. Anæsthesia of the body or of the internal organs may develop the delusion of being dead, the patient asking to be buried. Similar conditions are also present in dream life. Changes of cœnæsthesis play no doubt an important rôle in the activity of the dream consciousness. Changes in the various component elements that go to make up the obscure but highly complex life of organic sensibility affect profoundly the rich exuberant play of the dream consciousness. Since the channels to external stimulations are closed, the cœnæsthetic sensations that form the obscure basis of waking consciousness become the sole possessors and guides of whatever mental activity is present in sleep. These internal sensations are woven by the dream consciousness into phantastic images of all shapes and forms.

The dream consciousness presents many characteristics found in states of mental dissociation and disintegration. Moral tone is lowered, attention is greatly reduced, logical thought is enfeebled and the sensory-motor and ideomotor elements are thrown out of gear, often resulting in the formation of illusions, hallucinations and delusions. In the dream state there is present the mental degradation of dementia, the sordid delusions of hypochondria and melancholia, the delirious states of mania, the delusions of grandeur of general paralysis, and even the persistent systematized delusions of paranoia. The dream consciousness is extremely unstable, it forms no definite type of mental disintegration and has no determinate course, it is extremely

fluctuating in its states and its background is usually shifting ceaselessly. From this standpoint it may be said that the dream consciousness is a normal form of mental alienation and that mental alienation is an abnormal form of dream consciousness. A very characteristic diary brought to my notice in which a retrospective and introspective account is given by a patient in the normal condition of the experiences lived through in the state of mental aberration opens with the suggestive title: *Memories of my Dream Life* and with the following interesting introductory remarks:

"Where shall I commence? How shall I begin to recall and record this to me mysterious life I have been living? So beautiful, so strange, and in some way so terrible. Yet I would not forget, for it seems as though I must have been in communication with intelligences above — spirits of the air, if it were possible.

"When did it commence? How long has it been with me? are questions I cannot solve. For weeks before coming to the hospital I must have been living this 'ideal life' as in an 'ideal world.' I have jotted down what I have thought, though they are not one hundreth part of the thoughts which passed through my mind during this strange time of dreaming." In one of my cases of katatonia the frightful dreams of the year preceding the disease became hallucinations of the maniacal stages and appeared again as dreams during convalescence. The dreamer dreams with his eyes closed, the insane dream with their eyes open.

In both the dreamers and the insane the disaggregated states under the influence of external and especially of internal stimuli give rise to illusions, hallucinations and delusions. Dissociated states grouped round nuclei of primary sensations form the internal organizations of hallucinations and delusions so often characteristic of dream life and insanity. Cœnæsthetic sensations are important agents in the formation of insane delusions and hallucinations, there are so many fermentation nuclei among masses of dissociated states. Irritation of the ovaries may in the insane awaken hallucinations and delusions of a sexual character; constipation and heaviness in the intestinal

tract may generate delusions and hallucinations of rats and pigs in the stomach; rumbling in the stomach and the intestines may give rise to the delusions and hallucinations of devils in the body or of electric discharges of powerful batteries placed in the abdomen. The hallucinatory delusional dream consciousness works on similar lines — thus the first stages of migraine with a heaviness of the head may in sleep give rise to the dream hallucination of the head being opened, the brain swept away and chalk substituted; pain in the abdomen may form the hallucination of mice gaining an entrance into the abdominal cavity and gnawing at the intestines.

The difference between the walking life of the insane and that of dream consciousness is the mode of activity, the dream consciousness works in images, in sensory percepts, while in the insane mind the activity is largely representative. This difference is due to greater dissociation present in dream consciousness. The awakened dissociated systems in dream life become tinged with a perceptual sensory color by the process of absorption and assimilation of all the incoming sense impressions. Pathological states of rapid mental dissociation, such as the acute states of maniacal excitement or in states of psychopathic functional dissociation, such as the 'Dämmerzustande' of psychic epilepsy and other states of functional psychosis, closely approximate to the condition of dream consciousness, though the former are more stable and far more consistent, being narrowed to the active functioning of definite mental systems, conditions rarely to be met with in dream states.

The dream consciousness lacks unity of logical thought, certainly fails in critical judgment and is sometimes brutally indifferent to immoral situations and acts. The credulity of dream consciousness is well known to every active dreamer. Changes of time, place and of objects are often instantaneous and the most incongruent situations as well as transformations of personality are placidly and credulously accepted. The dream consciousness is entirely at the mercy of incoming sense impressions which spin the dream experience regardless of truth and reality and steadiness of logical purpose and moral ideals of the race. From this standpoint it may be claimed that

the dream consciousness is to some extent a reversion to the earliest forms of mental life, when the race was as yet undisciplined by the accumulated experience of ages of social life.

The teleological aspect of the dream consciousness may possibly lie in the fact suggested by some that the many trains of thought started in the activity of waking life and arrested and suppressed by the selective thought and logic of things and events of waking life find their vent and completion in the activity of dream consciousness. This vent relieves us from the high pressure of suppressed thought and makes it easier to sustain the rigid selection of sequences of mental states required by the struggle of existence and social life in our adjustments to the conditions of external environment. This view, however, is not strictly correct. For the dream consciousness follows not only along the lines of thoughts started in waking life, but more often forms new lines of associations giving rise to highly dramatic situations and far from relieving waking thought impedes and depresses it, since the mind feels unrefreshed by the sleep and in many cases serious mental troubles arise due to the disturbing influence of active dreams on the course of waking thought. It is more likely that there is little teleology to dream life and if any teleology there be, it may consist in the freedom and ease in which the mind finds itself in the dream state, fettered as the mind is by the rigid relations of the external environment. In dream life the routine of waking life is interrupted and new associations are formed. This possibility of forming new associations and thus breaking through the routine of life, a possibility maintained and fostered by the dream consciousness, might have possibly proved of the highest consequence to the human race. The dream consciousness may thus be regarded as an important factor in the progress of human thought, as an agent in the breaking up of habits of thought due to the routine of life and calling the attention of man, absorbed as he is with the interests and requirements of the needs of his physical world, to another life existence and strange universe of reality.

III.

The sense of reality and belief in external existence of the hallucinatory objects are quite strong in hallucinations and in some of the more vivid and intense dream states. In order to explain this seemingly anomalous sense of reality, it may be well to revert to our general principle of subsuming both the normal and the abnormal under the same general laws and processes. Although the abnormal is of the highest importance in revealing new relations which the customary and habitual normal seems to hide, as it is found for instance in the growth and development of physiology largely due to pathological research, still we must clearly remember that from a strictly scientific standpoint the normal and abnormal are but teleological concepts which are of importance for the practical purposes of our habitual life activity and possibly for classification of various types of phenomena, but which science is to reduce to the same laws and processes. The abnormal is the normal out of place. In mental life as in the phenomena of life in general the atypical, or the variation, helps to explain the typical, the normal and the latter in its turn explains the atypical, the abnormal. We may therefore turn to the criterion of the normal sense of reality and validity of experience as explaining the same relations in abnormal mental life and the latter in its turn may throw light on the 'reality and validity' of 'normal' experience. A brief review will suffice for our purpose. It may look as if we attempt to make an excursion into a domain not belonging to normal or abnormal psychology proper, but to epistemology. This may be so, but the nature of our subject brings us so closely to this problem that a brief discussion may help us to see the facts in a clearer light. Abnormal psychology with its various forms of mental aberration, such as are to be found in the phenomena of insanity, functional psychosis, hallucination, delusion, somnambulic states, hypnoidic states, is so intimately connected with aberrations of the 'sense of reality and validity' of experience that not only the abnormal psychologist, but also the clinician must take it into account from a purely practical standpoint. We shall view the problem only in so far as it directly concerns and illustrates the general subject of our discussion, namely hallucination and illusion, or fallacious perception.

The objective reality of the physical world is sometimes defined, and with best of reasons, as social experience, as experience common to ourselves and our fellow men, as experience which men share in common seems in contradistinction to the psychic experience which is essentially of an individual character. The tree yonder can be seen by everyone who possesses eyes, but my perception of the tree, or my idea of it, can only be experienced by myself. It may be said that this difference between the physical object and psychic state is a valid and valuable one. It is, however, neither general enough, nor specific enough. For on the one hand it may be claimed that from a more general philosophical standpoint even the physical object belongs ultimately to the individual only and on the other hand it may be claimed that psychic experience is communicated to our fellow men not only in terms of the physical object, but far more often in terms drawn directly from our psychic experience. Neither the physicist nor the psychologist will be quite satisfied with this point of view as both physical objects and psychic objects are entirely emptied of their specific contents and must remain at best in the dubious regions of epistemology. Still this social aspect of the physical object is significant and valid and is even used by the psychiatric clinician as a practical standard in the valuation of abnormal mental life in general and of insanity in particular. It may, therefore, be of great value even if we do not agree with the extreme way in which this view is sometimes put.

It is true that at the first glance we cannot help being struck by the import of the common or social aspect of external reality. We are well assured of the existence and presence of an external object, if we have the assurance of our fellow-beings, and what is accepted by our fellow men assumes the dignity and authority of actuality. A fact is regarded as existing beyond the shadow of any dispute, if every one can verify it in his own experience. The categorical necessity of our modern science rests entirely on this principle of validity: The social object is the valid object. This criterion of validity of the external object stands out specially clear and distinct in our standard of abnormal mental life. A belief is regarded as insane and delu-

sional, if it is in opposition to social beliefs and experience and is emphatically rejected by all other men. An object is regarded as illusory or hallucinatory, if it is treated as non-existent by other people; a desire, an action is considered immoral, if it is spurned by our neighbors. The real object is the social object, the valid belief is the social belief, and the social will is the moral will. The individual object, the individual belief, the individual will are treated as insane. One can not help noticing the semblance of truth in the assertions of those pathological anthropologists who put genius in the same category with insanity. What is social is alone true, valid and real, the individual is false, non-existent. The individual can buy the reality and truth of his being on condition of becoming social. Sociality is verity.

Let us now, however, try to break through, if for a moment only, the traditions of social *régime* with its criteria of social reality and validity. When being pricked or in getting a blow, or when cut or scratched, along with the experience of the sensation, the experience of the external stimulus is also given. In looking out of the window and seeing the tree with its green leaves moving in the wind, along with the perception of the sensory elements, primary and secondary, the external existence of the object tree is also given. Similarly in listening to the sounds of a familiar and dear voice and listening to the words as they form into phrases and sentences is not the sense of reality of the external object given along with the series of sound sensations? Sensation carries along with it the sense, the reality of its stimulus. It is not that the sense of reality is different from the sensation, it is given in the sensation itself. Similarly the percept and the sense of reality of the external object are not two different things; they are given together in the same process of perception and are identical. The percept tree is the perception of the reality of the objective tree yonder. The sensory process is also the process of the sense of reality. As Spinoza puts it in his *Ethics*: 'If the human body is affected in a manner which involves the nature of any external body, the human mind will regard the said external body as actually existing.' In seeing or perceiving the chair yonder we

do not perceive it as real, because of its social or common aspect — the reality of its existence is given directly in the sensory processes of the percept itself. Sensory elements involve the reality and existence of their stimuli; the percept involves the existence of the perceived objective content.

The sense of reality of the external stimulus or object is strengthened by association of the original sensory systems with other sensory systems, and the intensity rises in proportion to the number of systems of sensory elements, brought into relation with the functioning sensory system. If on perceiving an object, we wish still further to assure ourselves of its reality, we verify it by means of other sense organs. If one sees an apple and wishes still further to assure himself of the real presence of the object, he goes to it and examines it with his other sense organs, he touches it, presses it, bites it, tastes it. Kinæsthetic elements, being the most important in adaptations and reactions to the stimuli coming from the external environment, are possibly of all sensory elements the ones that give the keenest and most intense form of sense reality. Facts warrant us to assert with some show of probability that the sense of reality is chiefly centered in the sensory motor or kinæsthetic elements which serve as nuclei for other sensory elements. Whether this be correct or not, it remains true that the sense of reality is given directly by sensory elements and their combinations and organizations. The more systems of sensory elements are pressed into service, the stronger is the sense of reality and the more assured is the reaction to the stimuli of the external environment. In the evolutionary process of man's adaptation to his environment he becomes extended in being and grows more developed because of his social relations with other men. Man presses into active service the systems of sensory elements of his fellow beings. Adaptations and hence successful reactions to the external environment are now more assured and the sense of reality is still further emphasized and intensified. Throughout the course of intensification of the sense of reality the principle remains unchanged in a nature. The sense of reality is given by and consists in nothing else but the sensory elements.

Social experience may be regarded as more real or as giving

a more intense sense of reality, because of the greater number of sensory systems involved, but an object is not felt as external and real, because of its social aspect merely, the sensory aspect is by far the more fundamental. If one's perception of the house yonder is of a purely 'individual' character, not shared by his fellow men and even emphatically denied by them, the visual preception as such still directly perceives it as real, external and physical. Should furthermore this experience be intensified or confirmed by all the other senses — should he be able to touch it, to press it and feel its resistance, knock against it and feel concussion and pain, and have a series of tactual and muscular sensations by walking into the perceived house and around it, and should he further have this purely 'individual' experience of all the senses each time he comes to the same spot, the perceived object would then be a real, external, physical object and no amount of social contradication and lack of the ear marks of community could make it less real objective and physical. Epistemologically regarded, community may be sufficient for the purpose of reality; psychologically regarded, the real, existent physical object is essentially the perceived sensory object given by the 'community' of sensory elements. Sensory elements give the objective 'reals.'

IV.

From this long digression we may turn again to the question: "What is it that makes hallucinations in general and dream hallucinations in particular appear real, objective?" The solution is given in the question itself. We have shown in our analysis that hallucinations are essentially peripheral and sensory in character and do not differ in their make-up from sensation and perception in general which furnish the very foundations of our sense of reality. Hence hallucinations are real and objective, because of the constituent sensory elements. Strictly psychologically considered, percepts do not differ from hallucinations as far as process is concerned. Normal percepts differ from hallucinations mainly by the fact that the former are the habitual, the customary, confirmed by other systems of sensory elements and that in the struggle for life, they proved to call forth the fittest reaction.

Dream hallucinations, like hallucinations in general, are initiated by peripheral stimulations; even the so-called 'central' hallucinations are really peripheral in origin, the dream hallucinations naturally falling under the same category. The entrance of external peripheral stimulations being difficult in proportion to the depth of sleep and extent of hallucinatory dissociation, the internal sensations predominate in the functioning systems of dream life. For in sleep the activity of the internal organs, though depressed, still goes on uninterruptedly; the glands continue their function of secretion and excretion, the heart continues to contract and dilate, the blood goes on circulating through arteries and veins; the liver, the spleen, the stomach, the intestines, the lungs and other organs carry on their functions without a moment's arrest; the whole sympathetic nervous system, the vasomotor, the spinal cord, the medulla and other basal ganglia, all, contributing to the vast mass of internal sensations, can hardly be regarded as being asleep. All these peripheral internal sensations go to form nuclei of primary sensations around which secondary sensory elements become crystallized and organized and give rise to hallucinatory percepts — to dreams. To these must be added the external peripheral sensations coming from touch and pressure of bed clothes, from changes in the muscles, joints, ligaments, and synovial surfaces, from changes in the superficial temperature of the extremities from chemical changes in the olfactory and gustatory organs, from summation of minimal acoustic stimulations, and above all from changes in the visual apparatus and especially from the masses of light in the retina and macula lutea.

With the obscuration and dissociation of the mind the internal sensations along with the external peripheral minimal sensations come to the foreground of mental life. The dreaming consciousness stands in closer relation to the bodily functions than the waking consciousness, absorbed as the latter is with the intense stimulations coming from the external environment. The intense external peripheral sensations of waking consciousness obscures the weaker, but more constant internal sensations, as Hobbes puts it, much 'as the light of the sun

obscureth the light of the stars.' This intimate relation between internal sensations was clearly seen and pointed out by Hobbes; 'and because' he says 'the brain and nerves which are the necessary organs of sense, are so benumbed in sleep as not easily to be moved by the action of external objects, there can happen in sleep no imagination and therefore no dream, but what proceeds from the agitation of the inward parts of man's body; which inward parts for the connection they have with the brain and other organs, when they be distempered do keep the same in motion.'

Dreams often reveal in a symbolic form and frequently in phantastic and grotesque images the conditions of bodily function, conditions which the waking consciousness cannot detect, because they lie in the subconsciousness and cannot overstep the threshold of waking consciousness. It is here in the deeper regions of cœnæsthesis, that we have to look for those 'prophetic' dreams which seem to foretell some future event, some future state of the organism. An incipient irritation of the nerve endings in the teeth, an irritation not yet felt in the waking consciousness, may become the nucleus of a dream and give rise to a dramatic vision of sitting in a dentist's chair and being operated upon, a prevision that may actually become fulfilled soon after. The growth of a malignant tumor may be represented in a dream under the form of a savage dog making an attack and setting his teeth into the place where the tumor is to develop. An incipient affection of the stomach may appear under the vision of being eviscerated alive, or of having swallowed a mouse which gnaws at the intestines. Incipient organic affections, not yet felt in the waking consciousness, may thus become the starting point of a highly dramatic prophetic dream. Dreams of such a 'veridical' character often appear highly mysterious and their fulfilled prophecy seems nothing short of the miraculous and supernatural. There are many such cases on record, but the following may be regarded as typical.

A lady, a relative of mine, had a very vivid vision which proved 'veridical' and seemingly could only be accounted for on supernatural grounds. One evening, on being left in a room

all alone, she suddenly saw the apparitions of her deceased parents. The lady became very much frightened, but the parents quietened her and told her not to be afraid as they came to bring her good tidings. "You will give birth to twins, a girl and boy, name them after us, they will be strong and healthy." With this the apparitions vanished. The lady became very much agitated and, although she did not suspect to become a mother, still, being religious and a firm believer in spirits, she had implicit faith in the actual appearance of her parents, who appeared to her in order to bring her glad tidings from another world, and naturally she even began to prepare clothes for the promised twins. As this happened in a remote country place this prophetic vision soon circulated among all the neighbors and expectations were aroused as to the fulfillment of the prophecy. It soon became apparent that at least a portion of the prophecy was being fulfilled. The lady soon discovered that she was going to become a mother — the sceptics were somewhat confused, still they maintained their front, but they were completely silenced, when after a few months the lady gave birth to twins and that a boy and girl. The vision then did prove to be of supernatural origin.

If, however, we analyze the vision somewhat more closely, we find that it can easily be resolved into elements which admit of a perfectly natural explanation. The vision first of all occurred during the state of repose and was really a dream hallucination. Still this does not explain the fact that the hallucination appeared in such a dramatic form which turned out to be so strikingly prophetic. On further examination of the lady's history it was found that she lost both her parents but a few months before the occurrence of the hallucination and that this loss deeply affected her. This mental system was an important factor in shaping the course and development of the hallucination. At the same time there was another factor at work in the elaboration of the dramatically effective dream hallucination. The lady before she gave birth to the twins was already a mother of fourteen children. It is quite possible that, although in her waking state she did not suspect of being pregnant, still in her dream state, being cut off

from the intense external stimulations, she could more easily realize her condition from symptoms and changes in the internal organic sensations which now alone reigned supreme in the dream consciousness. These symptoms and changes in the organic sensations during the incipient stages of pregnancy could all the more be easily appreciated by the lady as she had ample experience of them before. Some special changes in the organic sensations such as the arrest of the menses, changes in the circulation, in the metabolism of the generative organs and other changes of similar nature served as so many peripheral stimulations which, in states of dissociation such as occur in the light states of sleep, favored the occurrence of a dream hallucination that took the form of apparitions of the deceased parents, because of the subexcitement of this particular system and because for the time being the system played a dominant rôle in consciousness. Moreover, the organic changes differed greatly from the previous experiences of similar kind, and it was therefore quite natural that the dreaming consciousness should suspect the coming of twins, a circumstance which connected itself all the more closely with the formation of the dream and was no doubt a factor in the determination of the appearance of the apparitions of the parents, which in turn, helped her further to confirm the intuition that she was to be a mother of twins. All this was represented in the dramatic form characteristic of dissociated states in general.

V.

States of dissociation, light sleep and especially the intermediary states occurring in the course of falling into deep sleep or coming out of it are especially favorable to the formation of hallucinations. Such conditions occur in abnormal mental states in hypnosis, in somnambulism, in hypnoidal and hypnoidic states, in the so-called psychic equivalents of epilepsy, in pure psychic epilepsy, and, generally, in states of functional psychosis. In the intermediary states between waking and sleeping, dissociated systems awake and become accessible to the influence of external stimuli. This is clearly shown in the hypnagogic hallucinations, as well as in the frequent dreams often taking place in the lighter sleep states usually before waking.

I have often observed in myself, when being fatigued and becoming drowsy and closing my eyes, how fast phantoms and scenes flit before the mental gaze, most of them being formed by the flitting masses of light in the field of vision. Often in closing my eyes and keeping quiet, so as to become somewhat drowsy, and watching the field of vision, not directly, but, so to say, from the corner of the eye, animals, figures, faces, can be seen forming and dissolving into mist. These phantoms can be directly traced to specks of light and masses of color coming from the retina and especially from the macula lutea. In many psychopathic cases, not only vision, but also sounds and voices are experienced as in some of my cases that have hypnagogic auditory hallucinations of voices. The dimly lighted up regions that lie on the borderland of sleep and waking states are peopled with phantoms, ghosts and apparitions.

Statistics seem to confirm this point of view, since about 50 per cent. of cases of hallucinations may be classed as 'borderland hallucinations.' Some recent critics in this field of inquiry strongly favor the view that hallucinations occur in dream states, hallucinations being nothing else but vivid dreams, the percipient not being conscious of having fallen asleep. This view is not new, it is favored by Hobbes. 'The most difficult discerning,' Hobbes tells us, 'of a man's dream from his waking thoughts is then when by some accident we observe not that we have slept.' Many cases no doubt admit of such an explanation. I myself had an experience of such a character. While sitting and studying one evening, I felt myself suddenly transported into my father's house and looking out of the window, seeing the scenery characteristic of the locality and hearing the voices of my parents in the next room, but I could not discriminate the words. The vision was so real that I was surprised to find myself again at my book and in a place hundreds of miles away from home whither my hallucinatory state had so suddenly transported me. The hallucination was so strong and real that had I not critically analyzed the conditions of its occurrence I should have been fully certain that the hallucination appeared in the waking state. As a matter of fact, I was fatigued from my studies and dropped off. The actual surroundings, the room, the

table, the book, the voices of my friends present, all disappeared from my view during the intermediary state, and when I came out of it I remember the start I gave in realizing once more the actual situation. According to records, hallucinations take place when the percipient is in bed, just after retiring, or about to wake up, or after waking. The percipient is really asleep, only he is not aware of it, so brief is the state and so intense and vivid is the hallucination. It may, therefore, be maintained with some show of truth that hallucinations are dreams and take place in sleep states.

We must guard, however, against carrying a generalization too far. This contention that hallucinations occur in dissociated dream states is somewhat overstated. It is true that hallucinations require states of dissociation, but this does not necessarily mean sleep states. Not all states of dissociation are dream states taking place in sleep, although it may be safely asserted that all dissociative states have many traits in common and are at bottom of the same nature. Hallucinations and dreams may be analogous, may be of the same structure requiring the same general conditions, but it does not for that reason follow that they occur in the same states, in sleep states. Dissociation with consequent hallucinations may also take place in waking states. Those who have studied hallucinations in different forms of mental diseases know that most of the hallucinations occur under widely different conditions and they further know that it is precisely in the waking states that hallucinations are most commonly present, while in the sleeping states they are more frequently absent. Insanity may be *compared* with dream states, but they are by no means *identical*. The important condition requisite for the occurrence of hallucination is dissociation and this condition often occurs in waking states, such as the hallucinations found in many forms of insanity, as for instance paranoia, hebephrenia, katatonia, general paralysis and other states of mental aberration. Even hypnotic and post-hypnotic hallucinations can hardly be claimed to have been really induced in dream states. They who have devoted time and labor to hypnosis know that the hypnotic state can by no means be identified with sleep and that in the very deepest stages

of hypnosis the subject is to all intents and purposes fully awake; he is full of activity, his eyes are open, his senses are on the alert — he is far more awake to external stimuli than even in his normal state. The mind is very active and the subject carries on long trains of reasoning, argumentations and discussions with the people around him; in short, the subject in the deep somnambulic state is in a condition the very opposite from that of the sleeping state. Hallucinations occur both in the waking and sleeping states and require dissociation as an indispensable condition.

VI.

If we inspect more closely the relation of the stimulus to the hallucination, especially to the dream hallucination, we find that the intensity of the content is disproportionate to the intensity of the initiating stimulus, to the peripheral sense impression. A comparatively slight stimulation often gives rise to a dream of a highly dramatic character. This exaggerated character of the dream hallucination is well known. Thus a prick of a pin may give rise to a dream of being attacked by robbers and finally being run through by a thrust of a dagger. The application of a warm bottle to the feet may develop a dream of ascending a volcano and walking on molten lava, while a cold stimulus may give rise to a dream of participating in a dangerous expedition to the North Pole. Pain in the head, impeded respiration and pressure in the region of the neck may develop, as in the case of a friend of mine, the horrible dream of being dragged into a narrow dungeon and then beheaded.

To explain this dream exaggeration a theory is advanced based on dissociation. It is claimed that dissociation tends to convert the physiological 'ideational currents' into sensory 'currents' and intensify and exaggerate the psychic states. Before discussing the theory it may not be amiss to examine the facts which the theory is called to explain. It is questionable whether the general relation of dream stimulus is quite correctly stated. It appears that the generalization is stated somewhat in the form of the well-known question: Why do great rivers flow by great cities? It is by no means generally true that the characteristic of dream consciousness is to exaggerate

stimuli received and work them up to a pitch so as to convert 'ideational into sensory currents.' The relation is far simpler. The dream does not necessarily as a rule exaggerate incoming stimuli and make of them exciting and sensational dream hallucinations. What happens is this: the commonplace non-exaggerated, unaffective dreams tend to fade away almost immediately on waking, while the impressive dreams are usually remembered. I have observed a number of dreams in my own case as well as in others and have found that the number of ordinary commonplace dreams far predominates over the striking and extraordinary dreams. Even in psychopathic cases in which subconscious dream life is often well developed, even in such states I have found in the cases which have been under my observation and experimentation that the commonplace dreams far predominate over the dramatic and extraordinary ones. The only way to convince oneself of it is to try to write down the dream immediately on waking. I find that the ordinary dream is very hard to hold in memory, it is elusive and is constantly slipping away from us, a special effort of attention is requisite to hold on to them; they are usually hazy, vague and confused. On the whole, the indifferent dreams really predominate, but it is only the impressive ones that remain in memory. Even the freshness and recency of the dream do not save it from falling into oblivion. Now while commonplace and indifferent dreams are forgotten older dreams, but more impressive, more awakening our emotions, especially emotions of fear, will be clearly and vividly remembered.

Still the fact that exaggeration and intensification of the sense impressions received by awakening a greater volume of secondary sensory elements and representations more often than in the waking state requires an explanation. This intensification may partly be due to the fact that in sleep sensory impressions often enter consciousness suddenly. This brings about a shock, awakening emotions which are conducive to a greater stimulation of a greater volume of secondary sensory elements and their accompanying representations. Even in the normal waking state sense impressions suddenly introduced into consciousness may cause a shock and give rise to an illusion, the

object appearing as something strange and formidable. We can often observe it in ourselves, when falling into a drowsy condition, a slight stimulus which we otherwise ignore will give us a sudden start. I often observed in myself when in a drowsy state and 'dropping off' how an ordinary stimulus such as a cough, for instance, will produce a shock affecting the visceral organs, the feeling being somewhat similar to the condition commonly described as a 'sinking sensation in the pit of the stomach'; the shock seems to reverberate all over the organism.

To this must be added another important factor, namely, the emotion aroused. When an object is perceived under conditions that do not permit its recognition or its assimilation and consequently its customary reaction, an emotion of fear, or that of fright is produced. Such is the case, for instance, when some objects impress us in the dark or when we get hold in the dark of some slimy, slippery and especially of moving objects. These two factors often work together inasmuch as an object suddenly introduced into consciousness is also not speedily assimilated so that the shock and emotion due to non-recognition or non-assimilation go together. Now in sleep stimuli entering into consciousness effect it in a sudden way and from the very nature of the sleeping consciousness the external stimulation is but imperfectly assimilated; both factors, shock and emotion, due to non-assimilation are present and sometimes give rise to a highly wrought up emotional state which is so apt to transform objects by arousing different systems of elements and at the same time to impress the memory powerfully.

It is claimed that the very fact of dissociation brings about an intensification of ideational states converting them into sensory states. Physiologically, the assumption is made that the sensory nerve cells can be set into activity not only by peripheral stimuli, but also by central 'currents' going from center to periphery. The sensory centers are like a bucket with water, the upsetting of the bucket being likened to the upsetting of the sensory centers, giving rise to sensations. This upsetting can be affected by peripheral 'currents.' Small intracellular ideational currents flow freely through the centers without upsetting

them. Now when an obstruction occurs in the sensory centers the ideational currents which otherwise flow out and disperse may accumulate, and aided by a chance activity of central character may upset the nerve cell in the same way as our bucket may be upset by the accumulation of water from the small incoming currents (like the ideational currents), when the holes and interstices through which they usually flow out are stopped up. The hypothesis as far as explanation goes is good enough, the drawback is that it explains too much. For it is hard to understand why intense dreams of this character do not occur more often.

Besides it is hard to realize how an idea can give rise to a sensation of any intensity by the mere agency of ideas, the sensation and its intensity being entirely a function of peripheral stimulation and consequent sense impressions. An idea, a representation, may be very vivid, but does not become a presentation or sensation. A sensation is not an 'intense' idea, nor is an idea a weak sensation. A series of sensations arranged in ascending or descending gradation of intensity may be likened to the continuous series of the spectrum in which there is a qualitative difference from line to line, a difference that admits of no substitution. A sensation the intensity of which is changed is a fallacious percept, a hallucination. A thunder clap perceived as a whisper, a whisper perceived as a thunder clap may be equally regarded as fallacious perception as any other change in the content of the percept. The rustling of leaves perceived as an explosion is as much of fallacious perception as when the paranoiac, for instance, hears in it curses and threats of his enemies. Sensations and percepts cannot change in content or intensity without giving rise to illusions or hallucinations. The changes that may occur in regard to sensations and percepts without their being qualitatively changed and becoming fallacious can only be in vividness belonging to the representative elements which cluster round the primary and secondary sensory elements. A less intense sensation may be more vividly represented than one of greater intensity. A weak sound, a pale color, a light pain may be more vividly represented than the ones the intensity of which is far greater. This vividness, however, is not at all a characteristic attribute of the sensory ele-

ments, it is rather an attribute belonging to the functioning system of representative elements into which the given sensory elements enter as constituent nuclei.

Keeping to facts as closely as possible we may venture without much risk on the following generalization which may be regarded in the light of a working hypothesis. Just as sensory primary or secondary sensory elements vary in intensity and can be arranged in a continuous series of gradations of intensities, so do the representative elements vary in vividness and may be arranged in a continuous gradated series of vividness. *Sensory elements have intensity, but no vividness, while representative elements have vividness, but no intensity.* Representative elements may refer to the same presentative content with different degrees of vividness. Vividness of representative elements like intensity of sensory elements may pass through all degrees of variation from *maximum* to *minimum* and finally reach a vanishing point. In this respect vividness is like sense intensity and as a matter of fact the two are usually interrelated.

Under ordinary conditions of psychic activity sensory intensity and representative vividness vary together. An intense sensation is vividly represented and a weak sensation less so, the vividness varying directly with increase or decrease of sensory intensity. This direct variation, however, is not always constant; there are conditions under which the two may part company such, for instance, as are found in states of distraction or in states of dissociation. Under such conditions a strong stimulation giving rise to sensory elements of great intensity may give rise to representative elements of but slight vividness. In states of distraction as well as in various states of mental dissociation sensations of great intensity may meet with so little vividness in the representative elements as to fall so to say below the threshold of consciousness, may be submerged into the twilight region of the subconscious and 'not be perceived at all.' From this standpoint we may say that the depth of dissociation varies inversely as the degree of vividness. When vividness is at its *minimum*, dissociation is at its *maximum*, and inversely. *Briefly stated, dissociation and vividness are inversely interrelated variables.*

VII.

Functional psychosis, the basis of which is dissociation, *may also psychologically be regarded*, according to the gravity of the psychopathic affection, *as a decrease or even loss of vividness of representative elements*. The diminution or total loss of vividness may be of different systems of representative elements and will thus give rise to various forms of psychopathic amnesias, which play such an important rôle in functional psychosis, which in the main is a disease of representative life consisting in a decrease of functional activity of representative elements and which from the present point of view may be regarded as *the tendency towards a minimum of the most important attribute of ideational elements, namely, vividness.*

From this standpoint, the degree of vividness of ideational elements can no more confer on them sensory intensity than the idea of riches, however vivid, can confer upon one the power of wealth. Dream hallucinations, like hallucinations in general, are sensory in character, not because of the intensive nature of the central elements or ideas, but because of the primary and secondary sensory elements present, directly and indirectly peripherally initiated, as it is in the case of all sensory and perceptive processes. Hallucinations are peripherally induced and are started either in the same sense organ, or indirectly in some other sense organ, the secondary sensory elements form so to say the hypertrophied portion of the hallucinatory percept, but *they are always sensory in character and peripherally initiated.* The more closely one investigates hallucinations, the more he learns to trace cases of supposed mysterious hallucinations to external peripheral sources. A pure central hallucination is as rare as the fabulous phœnix. A central hallucination means an unanalyzed psychic state. Whenever an analysis of such hallucinations is made, the peripheral sensory character, primary and secondary, stands out distinctly in the foreground. In the so-called 'purely central hallucination' the nuclear primary sensory elements remaining in the background of consciousness cannot easily be traced to their appropriate peripheral sense organs and their external stimuli and are on that account regarded as 'centrally initiated.' Dream hallucinations, hyp-

notic, hypnagogic and pseudo-hallucinations, if closely analyzed, can be clearly traced to peripheral origin, — to peripheral stimuli that give rise to primary sensory elements that form nuclei round which secondary sensory elements become organized as cytoplasm.

These so-called central hallucinations form the stumbling block of the psychologist and the psychopathologist. To account for them the theory is commonly advanced that the irritability of the ideational centers may reach such a pitch as to give rise to such intense ideational states as to amount to a full-fledged sensation or perception and thus bring about a pure central hallucination. It is strange that such a theory should be maintained at all and that it should gain currency. The theory does not accord with the facts, and its very principle disregards facts. For no matter what strength an idea may attain it is still far from becoming a sensation. An idea of a bell does not sound and an idea of a blow does not strike. The fact is, as we have pointed out before, ideas or representations are qualitatively different from sensations; an idea can as little be converted into a sensation as the sour taste of vinegar can be turned into violet color of the spectrum. Ideas and sensations differ fundamentally, they differ in kind and no amount of ideational activity can ever be made to become sensory in nature. A higher pitch of ideational activity will make an idea more vivid, but can nowise confer upon it sensory qualities, just as all the immensity of space and infinity or eternity of time can not make them weigh as much as a grain.

A further modification of the same theory is given by those who maintain that central hallucinations are due to the irritability of the higher ideational centers from which 'ideational' currents are propagated to the lower sensory centers. In other words, it is not the idea that becomes by its intensity or by its vividness directly transformed into a sensation, but an intense or vivid idea may give rise to a corresponding sensation without the presence of an external stimulus, or of a peripheral sensory process. Psychologically as well as biologically regarded, the theory is untenable. For it is not in accordance with observed facts that an idea, however vivid, should give rise to a corre-

sponding sensation or percept. Were that the case the course of internal and external worlds would have become confused and confounded, man would have become the dupe of his own ideas, the world a gigantic madhouse, and the process of ideational activity would have long ago become eliminated in the struggle for existence.

From a physiological standpoint, the theory can hardly be considered, inasmuch as it is in direct opposition to the known physiological laws. Sensory excitation, ideational processes and motor reaction form, so to say, a sensory-ideo motor arc, — the excitation going from peripheral sense organs to central systems and thence to the muscles. Now the conditions postulated by the central theory are such as to have the processes reversed. Sensory processes work upward, from periphery to center, while motor processes work downward, from center to periphery. On the modified central theory, the sensory process in hallucinations is reversed, it goes downward instead of upward. There is not a particle of evidence for such reversal, the assumption being in contradiction to the principles of physiology. The claim of special structures for effecting such a reversal is entirely unfounded. As far as can be ascertained, the neuron works 'cellulipetally' in the direction of the sensory ganglia and central neuron systems, while the neuro-axon works 'cellulifugally' that is from sensory ganglia and central neuron systems to the periphery to the muscular apparatus. There is on the other hand not the least bit of evidence that the functions of neuron systems can be reversed in their course.

The central theory then cannot stand the test of critical examination as it is neither in accord with the facts it is called to explain, nor does it fall in line with the facts and principles of physiology. We are therefore forced to fall back on the peripheral origin of hallucinations under the condition of central dissociation. According to the theory advanced in this paper, the origin, and structure of hallucinations, of dream hallucinations as well as of pseudo-hallucinations and hypnotic hallucinations do not differ in the least from those of normal perception, a difference unwarrantly claimed by the theories of central origin of hallucinations. *Hallucinations are peripherally*

initiated, hallucinations are abnormal percepts occurring under the conditions of central dissociation with primary and secondary elements as their central nuclei.

VIII.

The phenomena of so-called 'double thinking' are extremely interesting from our point of view. The patient hears his own thoughts uttered aloud. He has the hallucination of his thoughts uttered when engaged in writing or in reading, though loud reading may check the hallucinatory voices. These hallucinatory voices may be of an imitative character and simply repeat what is spoken or read by the patient; or they may be of an anticipatory character and utter the patient's thoughts before he himself utters them. The usual explanation of such cases is found in the theory of the so-called 'overcharged centers.' Where the voices follow and repeat the patient's words and phrases, it is assumed that the auditory centers are highly irritable and overcharged so that stimulations from other centers bring about a discharge into the 'ideational' auditory centers and auditory hallucinations result. In the case of reading, for instance, the visual image of the word awakens also an auditory image, but when the auditory centers are overcharged the visual images awaken directly an auditory image before the spoken word takes place. Now this auditory image is so intense, on account of overcharge, that it becomes an auditory hallucination and the patient hears his own thoughts uttered aloud. This reflex action from one 'ideational' center into another occurs while the patient reads or writes, and that is why he has the experience, the hallucination that there is a voice often regarded as 'inner' which repeats his own words and phrases. Cases where the voice utters the words and phrases before they are written are explained on the hypothesis that the central discharge into the overwrought auditory centers occurs before the words are written down or before the motor discharge takes place. When, however, the patient hears the voice repeat the phrases soon after he has uttered them, the phenomena are explained on the supposition that the centripetal currents from the speech centers into the auditory centers give rise to the voices, the patient hear-

ing his own words shortly after he has uttered them, the efferent discharge from the graphic centers into the auditory centers will give rise to an auditory hallucination of hearing the words and phrases he has just written. In the phenomena of 'double hearing' the patient has the hallucination of hearing his own voice while talking or reading aloud, and then again another voice due to the centripetal discharge from the speech centers to the overcharged auditory centers. Thus in some patients these hallucinations of hearing are brought about by the voluntary suppression of speech, the patient then hears a voice uttering his own thoughts. This is claimed as confirming centra initiation — the currents from the word images in the speech centers not having a free outlet run into the overcharged 'ideational auditory centers' and give rise to inner speech heard by the patient.

In opposition to this central theory of double thinking or of 'inner speech' held in various forms by psychologists and psychopathologists, there are some who maintain the view that these 'double thoughts' hallucinations are not of central, but of peripheral origin, being due to hyperæsthesia of the centripetal paths. The apparatus employed in speech carries out not only the requisite delicate movements, but also forms the sensitive apparatus for information of the movements executed. The sense of movement may be regarded as originating in the muscles, especially in the joints and articular surfaces. Sensory stimulations coming from these structures to their appropriate central systems give rise to kinæsthetic sensations and motor ideas. Now if the peripheral sensory tracts of the muscle sense or of kinæsthetic sensations become hyperæsthetic, kinæsthetic sensations and motor ideas are aroused automatically and may give rise to hallucinations of positions, movements and acts; movements which have not been performed are thus experienced. If now the centripetal sensory tracts of the speech centers are hyperæsthetic then involuntary kinæsthetic sensations and respective ideas arise which go to form the hallucinations known as 'double thought.' The patient experiences 'inner' speech, a voice repeats after him his own thoughts, his own words and phrases. When the speech centers are overcharged

and give rise to automatic centrifugal discharges, then the hyperæsthetic centripetal paths bring it back in the form of spoken words and the patient experiences his own thoughts uttered by an inner voice which is foreign to him. In speaking the inner voice comes after the speech and reverberates like an echo and persists as an 'after image' of the spoken word or phrase. When the patient is engaged in writing, the voice usually precedes the written phrase, because the spoken word image precedes the written word image, the inner voice thus anticipates the patient's writing by uttering his thoughts. This theory seems further to be confirmed by cases in which such hallucinations take place. If one observes closely cases of 'double thinking' or of 'inner speech,' he often finds 'involuntary whispering' present — the patient whispers to himself. These whispers come back to him, on account of the hyperæsthesia of the peripheral paths he hears it as speech of some inner voice.

A close examination of the two theories, of the central and of the peripheral, reveals their inadequacy. The central theory, as it is generally put forth and commonly accepted, may possibly be regarded as the more inadequate. For the central theory rests on the psychological fallacy, so prevalent in psychopathology that it may be regarded as the psychopathologist's fallacy, namely that an idea may reach such a high pitch of intensity as to become sensory in nature and give rise to a percept. The percepts formed by the visual perception of reading awaken, according to this theory, also accompanying ideas of sound intimately related associated with visual word reading, and it is these ideas that reach such a high intensity as to give rise to hallucinations of hearing, the words are read aloud, as if by a strange voice. This explanation, as we have already pointed out, is psychologically incorrect and rests on the fallacy that ideas have intensity and that an intense idea becomes a sensation, or that a sensation is but an intense idea and an idea is a weak, a faint sensation. To modify this view and assume that an intense idea stimulates and gives rise to the formation of a percept is to assume a supposition not warranted by facts that an idea is equivalent to the action of external stimuli or objects with their requisite physical structures and processes. In either case, the

central theory as it stands is not in accord with psychological and physiological data and, as such, cannot possibly be accepted at least in the shape as it is usually put forth.

Furthermore there is an inherent difficulty in the central theory itself. For if it be correct, as the theory claims, that the visual image calls forth an intense auditory image amounting to a hallucination, the hallucinatory voice should precede and not follow the patient's reading. In order to explain the hallucinations of double thinking or of double hearing in the case when the voice follows the reading, it would have to be assumed first that the visual image of the written or printed word stimulates the speech centers, which, innervating the muscular apparatus of speech, give rise to reading, which in turn stimulates the peripheral auditory apparatus, awakening activity in the auditory centers, giving rise to the hearing of the read words, and that then only do the indirect stimulations of the visual image coming from the visual centers awaken once more the same central connections, thus bringing about a repetition of the self-same words heard. We have to assume that the action of the visual centers in stimulating the motor speech centers with the resulting acoustic stimulations and functioning activity of the auditory centers are enacted before the direct central stimulations from visual center to auditory center take place; in other words we must *assume central retardation*. Now what does this central retardation mean? It means that the phenomena of double thinking or of double hearing are brought about by some form of central inhibition, of central blocking of pathways as it is usually put: in other words, the requisite condition of double thinking is reduced to the psychopathological state of central dissociation.

The inadequate side of the central theory as it is commonly advanced lies in the supposition of its referring auditory hallucinations in the phenomena of double thinking or hearing to the intensification of the auditory image or idea, but no straining of an auditory image can get a sound out of it. Moreover, were the central theory correct it would really involve a double auditory hallucination, one preceding and the other succeeding the reading. For in the process of reading the visual image of

the word awakens the auditory image along with its kinæsthetic image, stimulating the centrifugal motor apparatus and giving rise to the spoken word. Now this awakened auditory image preceding the spoken word, on account of the assumed irritability of the auditory centers and the consequent 'intensification' of the stimulated auditory images, should necessarily give rise to a full-fledged hallucination. When the voice also follows the reading, a dissociation of the visual from the auditory centers is assumed, a dissociation that gives rise to a secondary succeeding hallucination of the words and phrases read and spoken. The fact that the central theory requires the presence in all phenomena of double thinking that the voice should necessarily precede the reading; that when the voice follows the reading, another hallucinatory voice must have also preceded and that there is also a double stimulation from the visual into the auditory centers, that the hallucination first appears under conditions of association of visual and auditory centers, while the succeeding hallucination occurs immediately under the opposite conditions, namely dissociation, — all these assumptions make the central theory wholly unsatisfactory and unacceptable.

IX.

The peripheral theory of double thinking is on general grounds more acceptable as it falls more in line with psychological and physiological principles and facts. Unfortunately the special facts which the theory is called for to explain do not exactly tally with it and may even be said to contradict the hypothesis. For if the hallucinations of double thought are due to hyperæsthesia of the centripetal sensory-motor tracts, then reading aloud should intensify the hallucination, but the case is quite the reverse, — reading aloud makes the hallucinatory voice to disappear altogether. On this theory again, the voice should follow the reading. We are thus confronted with the opposite difficulty met with in the central theory. On the central theory the hallucination should precede, while on the peripheral theory the hallucination should follow the reading. The central theory cannot account well for succeeding hallucinations, while the peripheral theory does not account well for pre-

ceding hallucinations. On the central theory there should be double hallucinations in cases where the voice follows reading, while on the peripheral theory there should be double hallucinations, when the voice precedes the reading. Besides 'hyperæsthesia' alone should rob the perception of its hallucinatory character, the patient should be the more conscious of his own utterance.

A closer examination of the peripheral theory discloses a fundamental fallacy which it primarily involves, a kind of *ignoratio elenchi*. The theory is probably correct in principle, but it misses the essential point of the whole problem; it may be an adequate explanation for motor, but not for auditory hallucinations. Hyperæsthesia of the central motor speech tracts would at most give rise to pure kinæsthetic hallucinations. The patient may have hallucinations of action, tension, or of movements in his peripheral speech organs, but he will have no hallucinations of hearing. To have an auditory hallucination, as to have an auditory perception in general, the auditory peripheral and central apparatus should be stimulated. No other organ but the acoustic apparatus can possibly supply sensations and percepts of an auditory quality, unless the hallucination be of a reflex secondary character, but then it may be induced through any other peripheral source than that of kinæsthesis of the speech organs.

Although each theory taken by itself proves to be inadequate and leads to contradictions and puts us out of accord with facts, still the two may be regarded in a certain sense as supplementing each other, if modified by supplementary conditions. Now the central theory emphasizes the aspect of the central character of the phenomena, while the peripheral theory lays stress on centripetal factors; both, however, can be brought in line with facts, if assuming centripetal factors of kinæsthesic and specially auditory hyperæsthesia we also refer to the central conditions of dissociation. The patient in double thinking is subject to subconscious states, to states of dissociation; this dissociation is of central character and specially affects the visual and kinæsthetic systems. Impressions, on account of dissociation and peripheral hyperæsthesia, are subconsciously received and sub-

consciously reacted upon. The visual impressions of the written and printed characters are subconsciously perceived and subconsciously uttered in a whisper and sometimes quite loud, as I had occasion to observe in a case of mine. This subconscious utterance, unperceived by the patient, comes back to him as a strange external voice proclaiming the patient's thoughts or repeating his words and phrases. The hallucinations of 'double hearing' are due to subconscious whispering which comes back to the patient as an auditory hallucination. I had the occasion to verify this phenomenon of subconscious whispering in a case in which functional dissociation was quite marked and in which auditory hallucinations and double thought were quite persistent.

In cases where the auditory hallucinations precede the reading or writing it is the subconscious whispering along with kinæsthetic and auditory hyperæsthesia that give directly rise to the phenomena of 'double thought,' or of 'double hearing.' The dissociation being in the kinæsthetic systems the patient does not experience consciously the peripheral incoming sensations due to his subconscious whispering. More often the patient continues to whisper subconsciously what he has just read consciously. Such a habit is common with many people in the normal state and is due to the result of the persistence of the peripheral sensory impression, to a kind of verbal after-image. The absence, however, in the normal condition of dissociative states prevents the formation of subconscious whispering with its consequent auditory hallucinations partly due to hyperæsthesia of the auditory tracts.

If cases of 'double thinking' are closely examined one finds in them the presence of subconscious states with their psychomotor reactions, the patient in walking on the street, for instance, may hear a voice telling him words and phrases that can be traced to signs and advertisements which he has read subconsciously though he himself has not been aware of it. What happens in such cases is this, the patient whispers or even utters aloud the words he subconsciously sees on the signs. It is this subconscious whispering that comes to him back as an auditory hallucination of a voice. In one of my cases in which

the patients suffered from auditory hallucinations I found on close examination the phenomenon of unconscious or subconscious whispering, which became very much aggravated in proportion to the state of distraction in which the patient was, ranging from an almost inaudible whisper to a loud talk, the patient being entirely ignorant of it and could not be made aware of it, even when the attention was fully called to his talking. One of my patients suffering from pronounced auditory hallucinations, but in whom the dissociation is not deep, aptly describes his experiences as 'autovocalization.'

Similar conditions can be induced in hypnosis thus confirming our point of view by experiment on otherwise normal people. If a post-hypnotic suggestion of subconscious whispering is given, the subject experiences an hallucination analogous to that of 'double thought,' — the subject hears a voice telling him the words and phrases which he himself whispers, but of which he personally is entirely ignorant. The peripheral character of the 'double thought' or hallucination under condition of central dissociation may thus be regarded as an efficient working hypothesis in accord with facts.

From the whole course of our discussion it appears that we remain more closely in touch with facts, if we accept the view that hallucinations require states of dissociation as central condition and that they are primarily peripherally initiated having secondary sensory elements as their main content; in other words, hallucinations are *dissociated secondary percepts.*

DISCUSSION.

THE MECHANISM OF IMITATION.

The object of this paper is to explain the psycho-physical process by which acts of imitation are performed. We often hear imitation spoken of as an instinct, and of course, in the loose popular sense of the term, there may be no objection to speaking of the tendency to imitate as instinctive in mankind. But if we use the term instinct in a technical sense as applying to those acts which are made possible by hereditary paths of discharge in the nervous system, it seems impossible to bring our acts of imitation under this head. We can understand how a definite reflex might become hereditary. The act of swallowing when something is placed in the mouth, is a perfectly definite sensori-motor reflex, and we can easily conceive that the nerve arrangement necessary for this act should be prenatally established. But in the case of imitation we have no single definite act, but an indefinite variety of actions. No one definite set of nerve adjustments could explain such different activities as the imitation of sound, the imitation of a movement of the hand, and an imitation of the shake of the head. The very use of the single term imitation for such a large variety of actions, has a tendency to mislead. Many writers speak of imitation as if it were a sort of faculty, and this leads to the usual error of faculty psychology — the individual act is thought to be sufficiently explained when it is shown to be an instance of the general activity of the faculty. As James says there is no such thing as memory, but only memories, so we might say there is no such thing as imitation, but only imitative actions.

Our instincts are sensi-motor, our imitations ideo-motor. Since our ideas are not hereditary, but are always individual acquisitions, it seems necessary to regard the actions especially associated with these acquired ideas as also acquired. A movement which depends upon the perception of another's doings cannot be more original than the act of perception itself. In speaking of perception, Professor James says, "Nature is frugal in her operations, and will not be at the expense of a particular instinct to give us that knowledge which experience and habit will soon produce. Every perception," he says, "is an acquired perception."[1] Now this, it seems to me, applies to imita-

[1] *Principles of Psychology*, Vol. II., p. 78.

tion as well as to perception. Nature does not furnish us with particular instincts to give us those actions which experience and habit will soon produce. Every imitation is, I believe, an acquired imitation.

Many recent writers seem, however, to regard imitation as hereditary and instinctive. Thus Professor James himself includes imitation in his enumeration of the prominent instincts of man.[1] Yet he shows an apprehension of something other here than a single instinct by distinguishing 'the instinct to imitate sounds,' from 'the instinct to imitate gestures.' Had he carried this differentiation further he would soon have seen that the great variety of imitative acts precludes all thought of their reference to one or two hereditary instincts. Royce, in his recent *Outlines of Psychology*, speaks of the sources of the social interest, as instinctive and hereditary, and then goes on to say, "On the basis of the general social interests there appear more special instincts amongst which the most prominent is the complex of instincts suggested by the name imitation."[2] Tarde, in his *Laws of Imitation*, calls imitation the 'action at a distance of one brain upon another.'[3] He speaks of 'a will to imitate' as being handed down,[4] and he quotes from Maudsley with apparent approval the statement, "It cannot be too clearly apprehended that there is a sort of innate tendency to mimicry in the nervous system."[5] Baldwin's view is not entirely clear to me. He seems to regard imitation as an acquisition of the race, but as an instinct in the individual. At any rate he speaks of the 'imitative instinct,' and again refers to 'the instinct to imitate' as found in the child and in animals.[6]

In contrast with these writers who more or less definitely pronounce imitation an instinct, we may note this statement of Stout in his just published work, *The Groundwork of Psychology*. "Both spontaneous and deliberate imitation," he says, "presupposes a motor association between the perception or idea of the act to be imitated, and more or less similar movements which the child has already learned to perform."[7] Stout, it seems to me, is on the right track. He does not explain, however, the way in which these motor associations first arise. These motor associations, it seems to me, may be explained as follows: In same cases they are based on instinct. The

[1] *Ibid.*, p. 408.
[2] P. 275.
[3] G. Tarde, *Laws of Imitation*, trans. p. 199.
[4] *Ibid.*, p. 193.
[5] *Ibid.*, p. 88.
[6] Baldwin, *Mental Development*, p. 290.
[7] P. 82.

child instinctively cries at its own pain, and thus associates the sound of the cry with the cry movements. This association established, it becomes then perfectly natural, on the principle of ideo-motor action, for the child to cry when he hears another cry. In other cases the association between the idea and the movement may have been established by purely random activities. The spontaneous overflow of nervous energy makes the child wave his hands — he then sees the hand movement, and thus establishes a path of connection between the ideational process and the corresponding motor process. With this connection established, it is easy to understand how the child comes to wave his hand when he sees another perform the same act. In some cases probably the associations on which the imitative act depends may depend upon the imitations of others. Take the case of the imitative smile. The child cannot see his own smile and thus form a visual image of it, as he can of his hand movements. But the mother smiles when she sees the smiling face of the babe, and the child thus associates its own motor feelings of the smile with the visual idea of the smile as seen reflected in its mother's face. The necessary association is now established, and thereafter the child readily smiles when he sees others smile. In the case of vocal sounds while the imitation of the child by others may not be an absolutely indispensable factor, it is yet of great service in establishing the motor associations. To hear its own sound uttered by another, calls attention to it, makes its auditory image more definite and vivid and thus associates it more firmly with the movements of articulation. By means then of his original instinctive reflexes, his random movements, and the imitations of his movements, which he sees made by others, the child forms a sufficient fund of motor associations to explain his imitative acts, without the need of assuming any special instinct, endowment or faculty of imitation. Thus far we have considered only the first simple imitations of the child. But if these are not instinctive certainly none are. The more elaborate and complex imitations of later life are simply combinations and coördinations of the elemental movements already learned. As imagination can create nothing for which the ideational experience of the past does not supply material, so imitation can perform no act for which earlier motor experience does not furnish the elements.

Closely connected with imitation is sympathy. This connection is illustrated by an instance of my own son's babyhood. Whenever we repeated to him the nursery ditty — 'This little pig goes to market,' etc., he would always break out crying when we said the last line —

'This little pig cried Wee, Wee, Wee! I can't find my way home.' The 'wee, wee, wee' uttered in a somewhat pathetic tone of voice produced a cry which was certainly imitative, and perhaps in some measure sympathetic. One other example may be given — an incident related to me by a friend of his little two-year-old daughter. One day as the father was holding the child in his arms playing with her, she got quite a hard bump against his forehead and began to cry. To distract her attention, he took her hand, patted his forehead with it, and said, 'poor papa, poor papa!' The next day the child got a bump against a chair, and her father was much surprised to see her pat the chair and hear her say 'poor chair!' Certainly no one would claim that we inherit an instinct to sympathize with injured chairs and I believe there is as little ground for making sympathy an instinct in any case.

James again counts sympathy among the instincts,[1] and Baldwin regards organic sympathy as instinctive.[2] But much the same difficulties arise when we try to think how the vast variety of our sympathies can be accounted for by an inherited nervous mechanism as in the case of our imitations. In order to explain the first sympathetic feelings we need only to add to imitation the James-Lange theory of emotions. As already explained, the child cries when he hears another cry. He sees another in an attitude of pain or grief and imitatively assumes that attitude, but the assumption of the attitude excites the corresponding emotion and the child thus acquires the sympathetic feeling. But even if we do not accept the theory that the 'expression' makes the emotion, it is still unnecessary to regard sympathetic feelings as instinctive. The child does not feel the woes and joys of others until he has already experienced at least elemental feelings of the same sort in his own person. Having established then a certain fund of association between feelings and their outward expression, the imitation of the expression of feeling that he sees in others will awaken the kindred emotions in his own breast.

One objection to this experiential theory of imitation should be considered. It seems to be the social psychologists, and those who have approached the subject from the sociological side, who are especially inclined to regard imitation as an instinct, an endowment, or a quasi-faculty. When we think of the tremendous rôle which imitation plays in the development and education of the individual and in the entire organization and structure of society, can we regard it as any-

[1] *Principles of Psychology*, Vol. II., p. 410.
[2] *Social and Ethical Interpretations*, p. 222.

thing less than a native endowment? Or, to put the question more concretely, if imitation is only one type of ideo-motor action, why should it acquire such a preponderant influence? Why should the ideas enacted before us in the doings of our fellows take precedence in their influence on conduct over the numberless ideas of all sorts that crowd the mind? In answering this question we may note first that when a number of motor ideas are in the mind it is the one which is most interesting, the one which is most vividly apprehended, or which most forcibly strikes the attention, that is sure to be executed. From the first experience of parental care, to the last days of life, our social relations are of the utmost importance to us. There is therefore a constant and accumulative development of social interests. Where our interest is there our attention is. The child might wave its arms in imitation of the waving branches of a tree were it as interested in the tree as in the movements of its parents, brothers and sisters. Then too the movements actually enacted are much more clearly and vividly apprehended than those that are suggested by mere words or ideas that arise in mind. In fact many activities that can readily be understood when seen, can hardly be described at all. The gymnasium instructor may be quite unable to tell in words how he performs a certain feat, but by performing the feat in the sight of his pupils, they get a far clearer apprehension of it than words can possibly give. Moreover the very infertility of our minds as to ideas of conduct, makes us prone to follow the examples presented before us. We are endowed with a store of energy, we are bound to act, and given the proper motor associations the doings depicted before us offer the line of least resistance to our conduct. Lack of originality is as manifest in actions as in ideas, and it is therefore not to be wondered at that the doings made vivid by the acts of others, and enforced by the growing power of our social interests should have a dominant influence on our conduct. There is nothing then, it seems to me, in the importance of the rôle which imitation plays in individual and social life to invalidate this simple experiential theory of its workings.

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